Aug. 25, 1959 L. D. SANDERS 2,901,129

AUTOMOBILE PARKING APPARATUS

Filed March 21, 1957 4 Sheets-Sheet 1

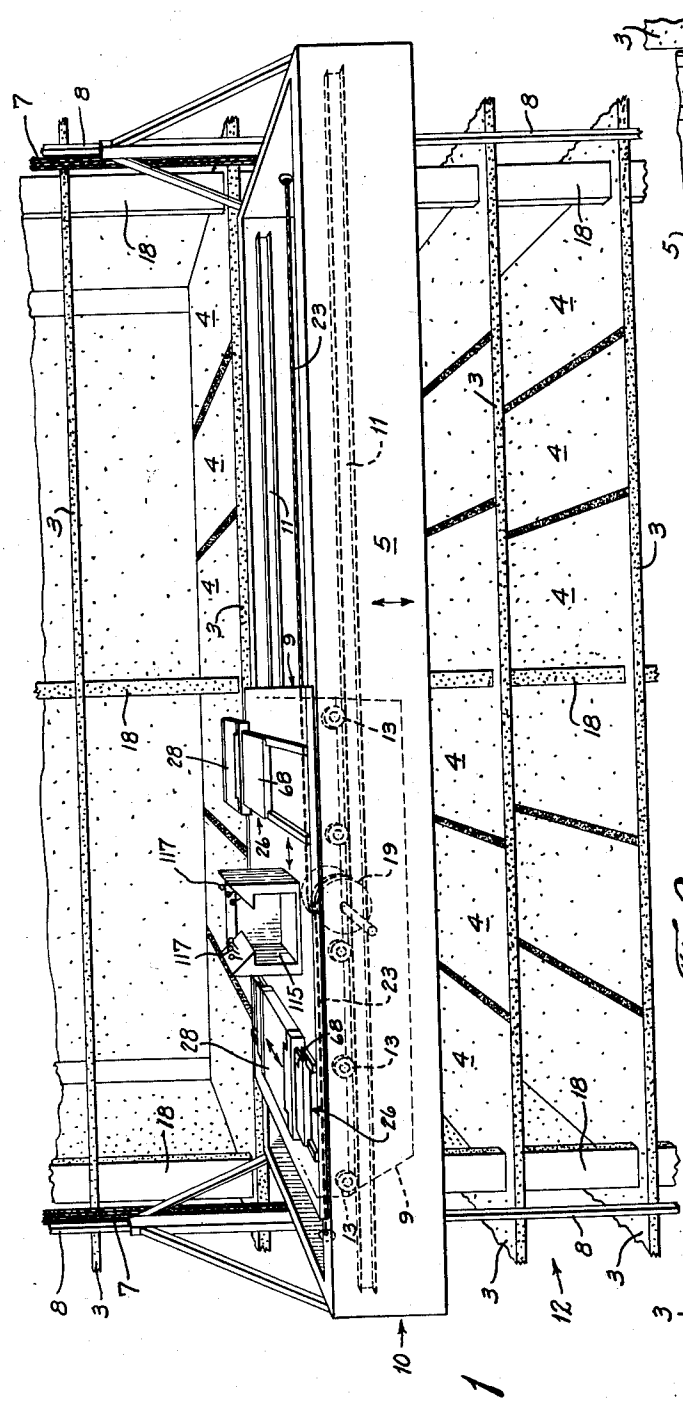


Fig. 1

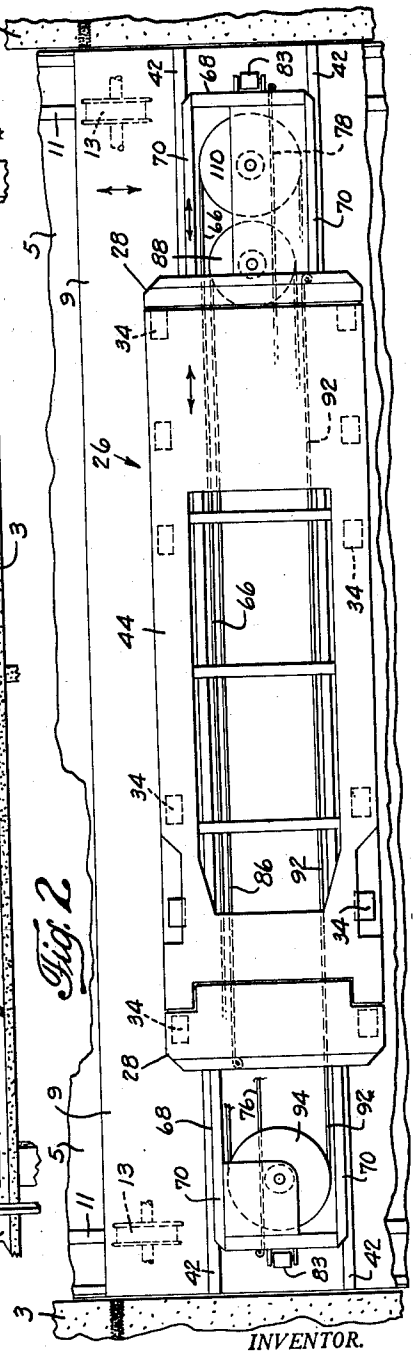


Fig. 2

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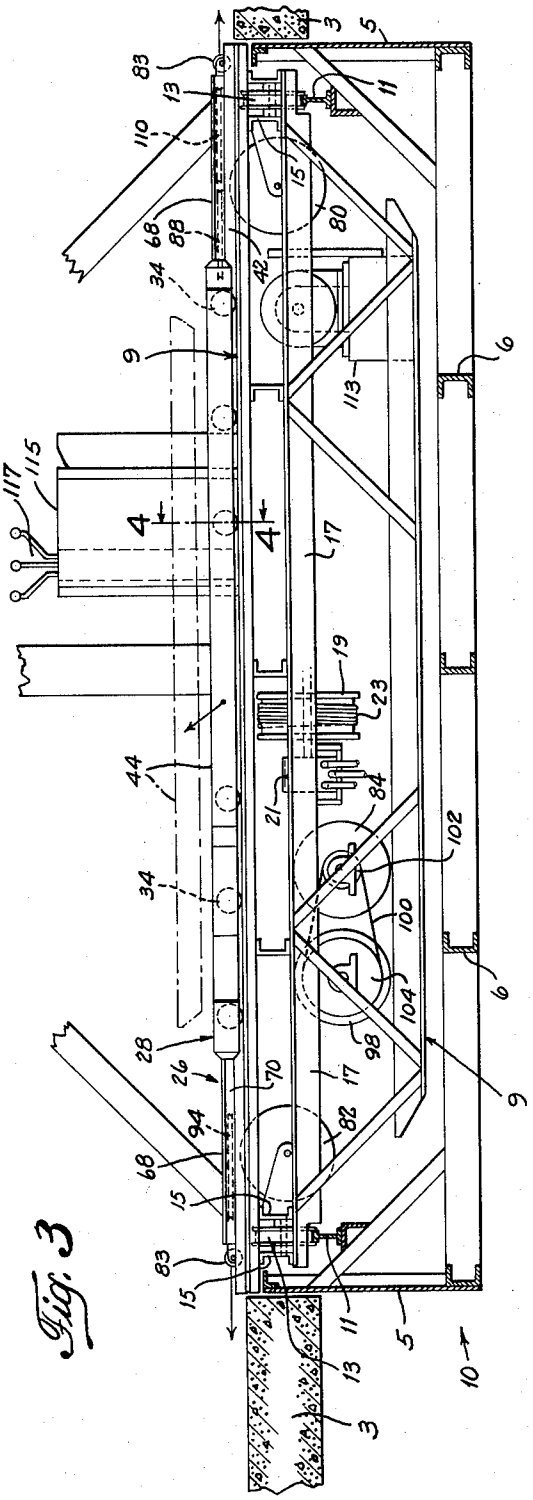


Fig. 3

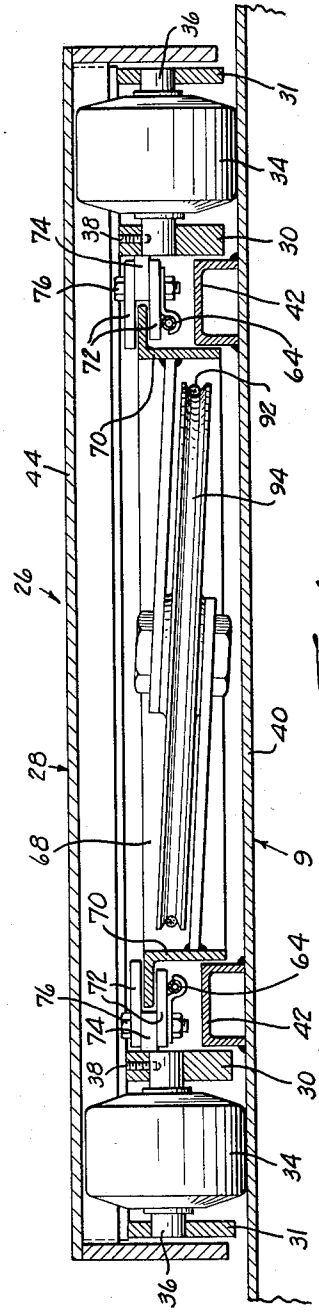


Fig. 4

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AUTOMOBILE PARKING APPARATUS

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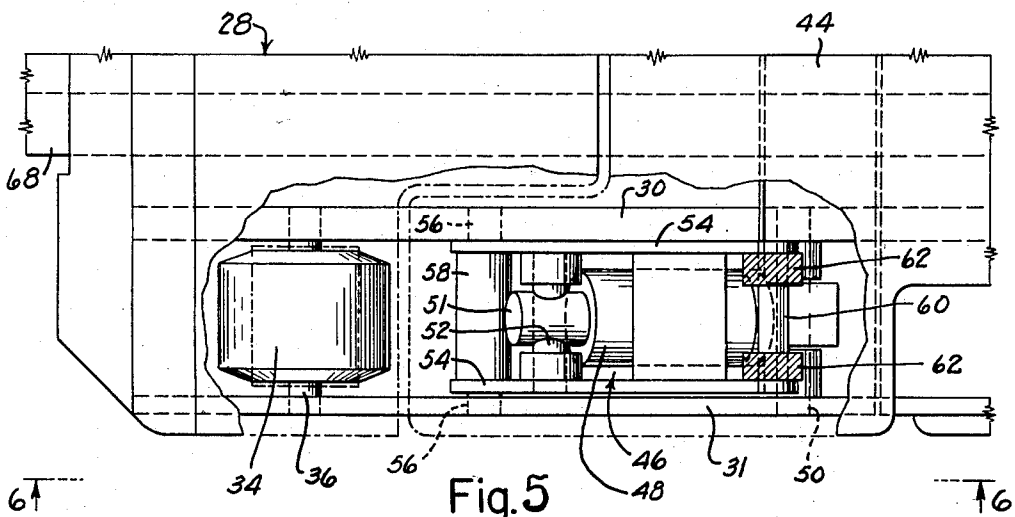


Fig.5

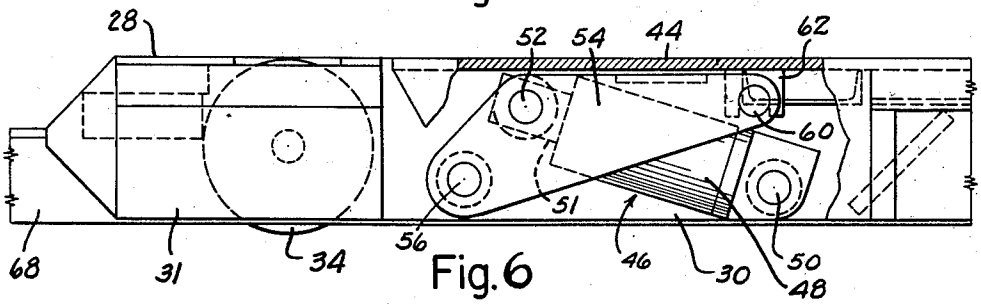


Fig.6

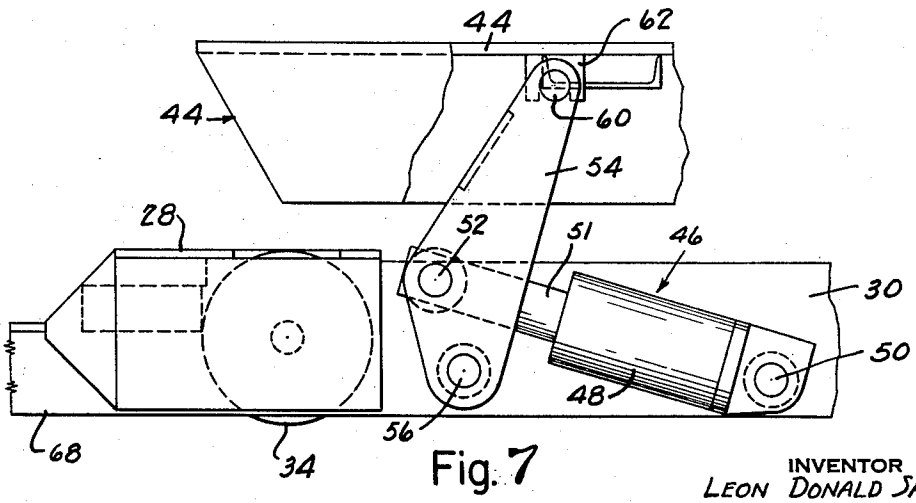


Fig. 7

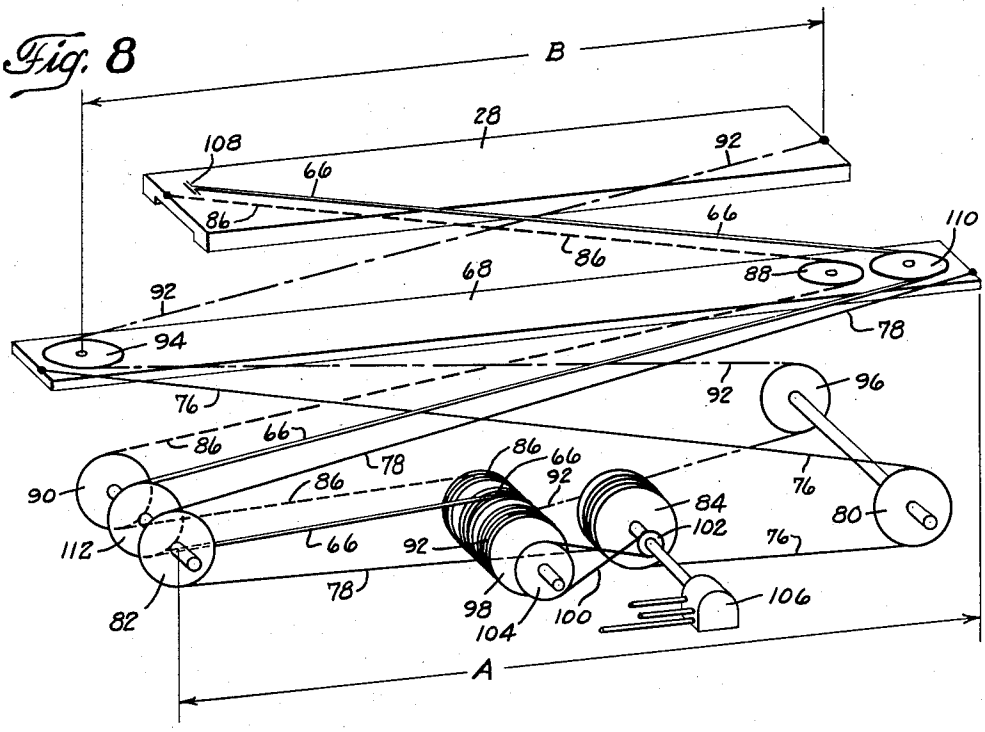
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AUTOMOBILE PARKING APPARATUS

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Fig. 8



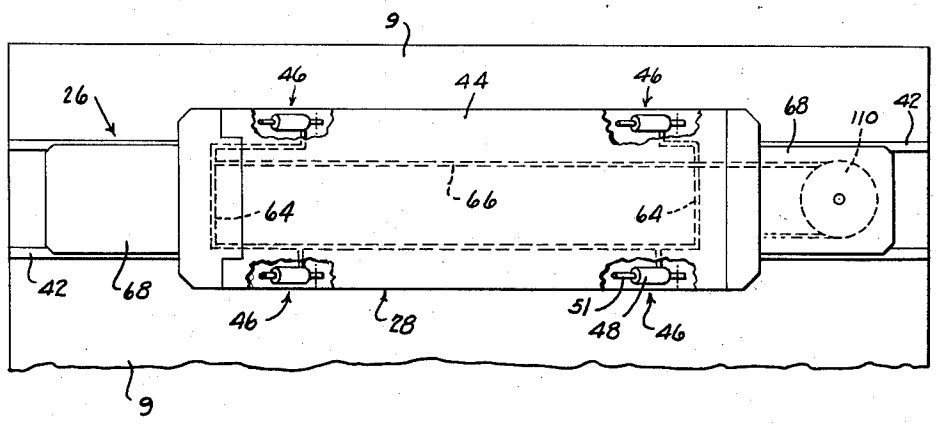


Fig. 9

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United States Patent Office 2,901,129 Patented Aug. 25, 1959

2,901,129

AUTOMOBILE PARKING APPARATUS

Leon D. Sanders, York, Pa., assignor to Systematic Parking Company, York, Pa., a body corporate of Washington

Application March 21, 1957, Serial No. 647,711

1 Claim. (Cl. 214—16.1)

This invention relates to an automobile parking or storage facility employing an elevator to convey automobiles to and from vertically spaced storage floors and is concerned with an improved arrangement carried by the elevator in such a facility whereby automobiles may be shifted laterally along the elevator and deposited or taken from any one of a number of side by side storage stalls with the arrangement being capable of simultaneously handling a pair of automobiles and with operations being controlled from a station on the arrangement.

It is the object of this invention to provide an improved parking or material storage facility wherein an elevator is employed to raise and lower vehicles to and from the vertically spaced floors in a multistory building structure and wherein the vehicles are transferred to and from the elevator from and to storage stalls on each side thereof by mechanical transfer apparatus. Another object is to provide, with such a parking facility, an elevator constructed and arranged to serve numerous parking stalls in side by side relation on each of the floors of the building and yet being extremely stable and not limiting the height of the building in which the elevator may be employed. Still another object of the invention is to provide, in such a parking facility, an elevator upon which is mounted mechanical transfer apparatus for transferring material to and from the elevator laterally thereof with the transfer apparatus being adjustable longitudinally of the elevator so that it may selectively serve a number of stalls. Another object of the invention is to provide, in such a parking facility, a horizontally elongated elevator platform upon which is mounted a carriage that is movable along the platform to communicate with the various side by side stalls that are adjacent the platform and with the carriage having transfer apparatus for transferring vehicles to and from the elevator from and to the stalls on each side thereof. Another object is to provide in a parking facility such an elevator mounted for vertical movement within a stationary support frame which forms part of the building structure and wherein the transfer apparatus is constructed and arranged so that the stress developed in the apparatus incident to the transfer of a vehicle to or from the elevator is kept at a minimum. Another object of the invention is to provide in a storage facility an elevator and transfer apparatus which is extremely rugged and stable, provides access to many side by side stalls on each floor of the building and on opposite sides of the elevator in a convenient, expeditious and economical manner.

Figure 1 is a fragmentary perspective view of a multistory building structure having two horizontally spaced banks of storage stalls between which is located an elevator for conveying vehicles and the like to and from the stalls, with the elevator and one bank of stalls being shown in this view.

Figure 2 is a plan view of one of the transfer devices mounted on the carriage which forms a part of the elevator and showing the transfer device in its central position between the two banks of storage stalls;

Figure 3 is a side view of the elevator showing it spanning the space between the banks of storage stalls and showing the relative position of the various elements of the elevator and the power driving mechanism for these elements;

Figure 4 is a sectional view taken transversely through the dolly and extension slide as mounted on the floor of the carriage and is taken generally along line 4—4 of Figure 3;

Figure 5 is a fragmentary plan view of one corner of the dolly partially broken away to show the detailed construction of the dolly's rollers or wheels and the fluid pressure operated jacking mechanism;

Figure 6 is a side view of the portion of the dolly shown in Figure 5, taken generally from line 6—6 of Figure 5, and also being partially broken away to show the detailed construction of the fluid pressure operated jacking mechanism;

Figure 7 is a view similar to that of Figure 6 but showing the jacking mechanism in its elevated position;

Figure 8 is an exploded diagrammatic perspective view of the dolly and extension slide, together with the cable drive mechanism therefor and the flexible hose for supplying fluid pressure to the jacking device on the dolly, and;

Figure 9 is a plan view of the dolly and extension slide showing the location of the four fluid pressure operated jacking devices for the dolly with the fluid pressure supply conduits for these jacking devices being indicated in dotted lines.

In accordance with the present invention there is provided a multistory building structure which has a shaftway extending upwardly therethrough with the shaftway being horizontally elongated and with each floor of the building having side by side stalls extending outwardly from the shaftway on opposite sides thereof thereby forming two banks of storage stalls, one on each side of the shaftway. The width of the shaftway or in other words the horizontal space between the two banks of storage stalls is slightly greater than the length of a standard passenger automobile.

In this shaftway is an elevator for raising or lowering vehicles to or from any desired stall with the vehicles being moved from the elevator to a desired stall and from such stall to the elevator by means of a suitable mechanical transfer device mounted on the elevator. The elevator is mounted in a stationary frame which preferably forms part of the building structure and the elevator includes an elongated platform which is vertically movable within this frame and extends past numerous of the side by side storage stalls. Mounted on the platform is a carriage which is movable longitudinally of the platform with a motor drive being provided for the carriage to position it in any desired position along the platform so that it may be opposite or positioned in front of any desired stall. The transfer apparatus for transferring vehicles to and from the elevator is carried by this carriage and by positioning the carriage in its proper place longitudinally of the platform the transfer apparatus will transfer vehicles to or from the carriage from or to any desired stall along the length of the platform. This transfer apparatus includes a dolly which is movable transversely of the carriage to and from the stalls on each side of the elevator with the dolly including a hydraulically operated jack frame for raising the vehicles and supporting them on the dolly. The dolly is moved laterally of the elevator by means of an extension slide which is positioned beneath the dolly and slidably carried by it. This extension slide is moved laterally of the elevator by means of a suitable cable drive mechanism to extreme positions where it extends substantially its full length from either side of the carriage into a storage stall. Motor means is provided to operate this cable drive and

through a suitable cable arrangement movement of the extension slide is effective to move the dolly with the drive arrangement for the slide and dolly being constructed and arranged so that the dolly extends laterally of the elevator a sufficient distance so that two vehicles may be stored in tandem in the stalls but with the acceleration of the dolly and accordingly the vehicle being relatively low, and with this drive permitting the dolly to be of a minimum length sufficient to engage the undercarriage of the vehicle.

It will be understood that the foregoing general description and the following detailed description as well are exemplary and explanatory of the invention but are not restrictive thereof.

Referring now to the drawings, wherein like reference characters are used throughout to designate like elements, the illustrative and preferred embodiment of the invention shown therein comprises the multistory storage building **12** which has numerous vertically spaced floors **3** each of which is provided with horizontally adjacent or side by side storage stalls **4** with these stalls being only wide enough to accommodate, without difficulty, a standard passenger automobile and long enough to accommodate two such automobiles in tandem. Within building **12** is the elevator **10** which is horizontally elongated, as shown in Figure 1, so that it extends in front of numerous storage stalls (six in the illustrative embodiment), and which is positioned in a suitable shaftway in the building so that it is in effect positioned between two banks of storage stalls, one on each side, whereby vehicles may be transferred to and from opposite sides of the elevator from and to the storage stalls of these opposed banks. The distance between the horizontally spaced banks of stalls and accordingly the width of the elevator positioned between these banks is only sufficiently great to accommodate a standard passenger automobile lengthwise, with a standard passenger automobile, as referred to throughout this application, being generally 19 feet long and 6 feet wide.

The vehicles are conveyed to and removed from the storage stalls by the elevator **10** which comprises elongated platform **5** which is mounted within a suitable frame that preferably forms part of the structure of the building, with upright column members **18** forming part of this frame as well as part of the building support and upright members **8** also forming part of the frame. Vertical movement of the platform within this frame is had through a conventional hydraulically operated cable drive mechanism, with the details of this drive not being shown, with only the attachment of drive cables **7** being indicated. The platform is made up of structural steel elements including longitudinally extending channels **6** and side and end plate members.

Mounted on platform **5** is carriage **9** which is moveable longitudinally of the platform and preferably has a length so that it extends across or in front of several storage stalls, with the carriage extending across three stalls in the illustrative embodiment shown in Figure 1. In order that the carriage may move easily along the platform to and from the opposite ends of the platform rails **11** are mounted on the platform so that they extend longitudinally thereof and the carriage is provided with a number of wheels **13** adjacent the opposite edges of the carriage with these wheels being mounted between longitudinally extending channels **15** which are in turn mounted upon transversely extending support beams **17** and with these wheels being received upon the rails **11** as shown in Figures 1 and 3. Vehicles that are to be stored in or removed from the building **12** are carried to and from the ground floor and the particular storage stall upon carriage **9** with the carriage moving vertically with platform **5** to the proper floor and longitudinally of the platform to a position where the transfer mechanism that is mounted on the carriage in opposite or in front of the proper stall. Longitudinal movement of the carriage along the platform is had through a motor driven cable drive which includes drum **19** mounted on carriage **9** and driven by the hydraulic motor **21** in either direction. Wound around drum **19** is cable **23** which has its opposite ends connected to the opposite ends of platform **5** (Figure 1) so that upon rotating the drum in one direction carriage **9** is moved longitudinally of platform **5** along rails **11** in one direction while rotation of the drum in the opposite direction will cause the opposite movement of the carriage.

Vehicles are mechanically transferred to and from carriage **9** by a transfer device designated generally **26** with there being two such devices on carriage **9** in the illustrative organization and with these two devices preferably being spaced apart the width of one storage stall, this space being utilized for control purposes as later explained. Thus the transfer devices are adjacent the ends of the carriage so that each of the storage stalls in front of which platform **5** extends may be served by a transfer device by proper positioning of carriage **9** on the platform. Each of the transfer devices includes dolly **28** positioned crosswise of carriage **9** and adapted to support a vehicle to transfer it to or from the carriage. The dolly is comprised of a rigid frame which includes elongated structural members **30** and **31** (Figure 4) extending along each side of the dolly. Intermediate these members are mounted numerous rollers **34** each of which is journaled upon a shaft **36** which is received within suitable bores in these elongated structural members and is retained in place in any desired manner such as by set screws **38**. These rollers engage the floor **40** of the carriage and provide for easy movement of the dolly across the carriage and into the stalls on either side thereof. The dolly is guided in its movement by the channels **42** welded to and extending across floor **40** and positioned immediately inward of structural members **30** of the dolly frame.

In order to support the vehicle upon the dolly the dolly is provided with jack frame **44** which extends substantially the full length of the dolly, as best shown in Figure 2, and which may be raised relative to the dolly frame through the action of fluid pressure operated jacking mechanisms **46**, one of which is shown in detail in Figures 5, 6 and 7. There are four identical jacking mechanisms **46**, one being provided at each corner of the jack frame, as indicated in Figure 9, and each of these mechanisms includes a fluid pressure operated jack **48** positioned between members **30** and **31** and pivotally mounted at one end to shaft **50** extending between and supported by these members. The other end of the jack or, as shown, the piston rod **51** extending from the jack is pivotally mounted to shaft **52** secured to and extending between the spaced levers **54**. These levers are pivotally mounted upon shaft **56** which extends between and is supported by elongated frame members **30** and **31** with spacer sleeve **58** being positioned over this shaft and maintaining the levers in spaced relation. Secured to and extending between the other end of these levers is rod **60** which is received within the downwardly facing recesses in the spaced brackets **62** that are secured to the underside of the jack frame. Through this arrangement both the jack **48** and the spaced levers **54** occupy a generally horizontal position when the jack frame is in its lowered position as shown in Figure 5 so that the jacking apparatus does not occupy any substantial vertical height and in fact is accommodated within the height required by the rollers **34** of the dolly. In raising the jack frame, jack **48** pivots the separated levers **54** about shaft **56** to where the levers are substantially vertical thereby raising jack frame **44** as shown in Figure 7 to where it would engage the undercarriage of a vehicle and thereby support the vehicle from the dolly. The fluid pressure operated jacks **48** are supplied with fluid pressure or a motivating fluid through a suitable supply manifold which includes conduits **64** mounted upon the frame of the dolly and supplied through the flexible supply conduit **66**.

The dolly is, as shown in Figures 2 and 3, substantially shorter than the width of the carriage and is only of a sufficient length to accommodate the undercarriage of a vehicle with a length of 17 feet being satisfactory for this purpose. However, notwithstanding this relatively short length of the dolly it is moved from the carriage to the stalls on either side a distance sufficient that two cars may be stored in tandem in these stalls and to achieve this, lateral movement of the dolly is effected through the action of extension slide **68** mounted beneath and slidably carried by the dolly with the extension slide being provided at each of its sides with an angle bar **70** the horizontal leg of which is received between spaced brackets **72** spaced on either side of support bracket **74** which extends laterally from frame member **30** with the brackets **72** being retained in place by bolt **76**. The extension slide is substantially longer than the dolly, preferably being slightly shorter than the width of the carriage and extends an equal distance from each end of the dolly when the dolly is in its normal position midway between the sides of the elevator with the dolly and extension slide being in their normal position, i.e. not in an extended position from either side of the elevator, in Figures 2, 3, 8 and 9.

Longitudinal movement of extension slide **68** to and from extreme positions where it extends substantially its full length from either side of elevator **10** onto the floor of the stalls is effected through a cable drive mechanism that includes cables **76** and **78** (Figure 8) which are respectively secured to opposite ends of the slide and are respectively passed over sheaves **80** and **82** journaled to the carriage adjacent its respective sides with the cables then being wound in opposite rotative directions about drum **84**. By rotating drum **84** counter-clockwise, as viewed in Figure 8, extension slide **68** will move to the left with cable **78** being wound on drum **84** while cable **76** is unwound from or played off of the drum at an equal rate, with rotation of this drum in the clockwise direction having the opposite effect. The sheaves **80** and **82** are positioned close to the edge of the carriage in order that maximum longitudinal movement of the extension slide may be had. The distance between the end of extension slide **68** to which the cables **76** and **78** are attached and the axis of the respective sheaves **80** and **82** over which these cables are trained when the slide is in its centered position on the elevator is the distance that the slide may be moved laterally of the elevator in each direction by the cable drive with this distance being designated A in Figure 8. As the slide is extended off the elevator into the oppositely disposed stalls one of the rollers **83**, mounted on opposite ends of the slide, engages the floor of the stall and rolls therealong providing easy movement of the slide.

In lieu of employing two separate cables **76** and **78** a single continuous cable may be used having its center portion wound about drum **84** and connected at its ends to opposite ends of extension slide **68**.

The movement of extension slide **68** is operative to move dolly **28** crosswise of the elevator into the stalls on opposite sides thereof through the medium of another cable drive organization. This organization includes cable **86** connected to the left end of the dolly as viewed in Figure 8 and successively passed over sheave **88** mounted on extension slide **68** at the opposite or right end of the slide and over sheave **90** mounted on the left side of the carriage and preferably in coaxial relation with sheave **82**. Connected to the other or right end of dolly **28** is cable **92** which is passed over sheave **94** mounted on the left end of slide **68** and over sheave **96** mounted adjacent the right side of the carriage and preferable in coaxial relation with sheave **80**. These cables **86** and **92** are wound about drum **98** in opposite directions so that as this drum is rotated in a clockwise direction cable **86** will be wound on and cable **92** will be unwound from this drum at the same rate with the opposite or counter-clockwise rotation of the drum having an opposite effect.

When extension slide **68** is moved to the right by winding cable **78** on drum **84**, dolly **28** is also moved to the right by means of cable **86** because the sheave **88** over which this cable is trained is mounted upon and moved with extension slide **68**. If cable **86** were anchored to the elevator, i.e. if drum **98** remains stationary, dolly **28** would move at twice the speed of extension slide **68** and would move relative to this extension slide the same distance that the extension slide moves relative to the elevator. However, the maximum distance that dolly **28** may move relative to extension slide **68** in either direction from a position where the dolly is centered with respect to the slide (Figure 8) is the distance from the end of the dolly to the axis of the sheave on the extension slide over which the cable connected to the respective end of the dolly is trained with this distance being designated or indicated as B in Figure 9. Since the distance B or the maximum movement of the dolly relative to the extension slide is substantially less than the distance A or the maximum movement of the extension slide relative to the elevator it is necessary that the drive cables **86** and **92** be respectively unwound from drum **98** when they are effective to move the dolly in response to the movement of the extension slide and with the rate at which they are unwound being such that as extension slide **68** moves through distance A dolly **28** will move relative to the extension slide through the distance B. This accomplished by interconnecting drums **84** and **98** through a suitable drive mechanism such as belt **100** which passes over pulleys **102** and **104** mounted on and secured to the shafts of drums **84** and **98** respectively. The relative diameters of pulleys **102** and **104** are such that as drum **84** is rotated to wind cables **76** or **78** thereon and move extension slide **68** to the right or left through the distance A to its extreme position where it extends substantially its full length from the elevator drum **98** will be rotated to respectively unwind cable **86** or **92** at a rate so that as extension slide **68** moves through its distance A dolly **28** will move relative to the extension slide and in the same direction as the extension slide through the distance B. The drums **84** and **98** and accordingly the entire transfer mechanism is power driven by means of the reversible hydraulic motor **106** which, as shown, is directly connected with the shaft of drum **84**.

With this extension slide and dolly arrangement the dolly may be moved laterally of the elevator into the stalls on either side thereof a maximum distance such that two cars may be stored in tandem in the stalls from the elevator and with the acceleration and size of the dolly being maintained at a minimum and at the same time with the crosswise dimension of the elevator being maintained at a minimum to accommodate a standard passenger automobile. This is so since extension slide **68** is of a maximum length being only slightly less than the width of the carriage and is moved crosswise of the elevator a maximum distance equal substantially to the length of the slide. Dolly **28** is thereby permitted to be a minimum length sufficient to accommodate the undercarriage of a vehicle and is moved relative to slide **68** a minimum distance which is substantially less than the distance the slide is moved relative to the elevator thereby maintaining the velocity and acceleration of dolly **28** at a minimum for a given velocity for the extension slide. This provides for minimum tension or stresses in both the cables **86** and **92** secured to dolly **28** and cables **76** and **78** secured to extension slide **68** as well as minimum stresses in the mountings for the various sheaves, the drums and other structure of the transfer mechanism. Maintaining the velocity of dolly **28** at a low value is particularly significant since the accelerative force or force necessary to accelerate and decelerate the dolly is a function of a square of

the velocity (½ mv.²) with this accelerative force being of substantial magnitude since in addition to the mass of the dolly, the mass of an automobile is involved.

To illustrate the distance that the dolly may be moved from the elevator and accordingly the distance that a vehicle may be moved into one of the stalls if it is assumed that the elevator is 23′ wide, with a dolly 17′ long, an extension slide 22′ long and with the sheaves mounted on the elevator being 6″ from the edge of the elevator the dolly may be moved a maximum distance of 38′ 6″ from either side of the elevator, providing adequate extensions for the storing of two vehicles in tandem in stalls.

Fluid pressure is conveyed to the dolly for actuating the jacking mechanism which forms a part of the dolly through the flexible hose or conduit **66** with this hose being connected at one end to T-fitting **108** on the dolly and disposed in generally parallel relation with cable **86** being successively trained over sheave **110** mounted on the opposite end of the extension slide and sheave **112** mounted adjacent the edge of the elevator and preferably in coaxial relation with sheave **90**, with the other end of the hose being wound around drum **98** in the same direction as cable **86** so that this cable and hose are simultaneously and at the same rate wound on and unwound from the drum. The cable is thus prevented from being fouled during operation of the transfer mechanism and assurance provided that it will not thereby become accidentally ruptured. While sheaves **110** and **88** are diagrammatically shown spaced from one another longitudinally of and at the right end of slide **68** this is for the purpose of illustration and explanation only and in practice they would preferably be mounted coaxial of one another or in side by side relation so that they would both be positioned at the extreme end of the dolly.

Fluid pressure for actuating the dolly jacking mechanism as well as for actuating hydraulic motors **21** and **106** for moving carriage **9** along the platform and moving the transfer mechanism laterally of the carriage, respectively, is supplied through suitable connecting conduits from the fluid pressure source **113** carried on the under frame of the carriage and which may include an accumulator and pump. The control of the supply of this pressure to these fluid pressure actuated devices is had from control booth **115** located on the carriage floor between the two transfer devices **26** and upon which booth are mounted suitable controls **117** for individually controlling movement of the carriage and transfer devices and the jacking mechanism. The control booth includes a pair of control panels between which the operator stands with each panel being arranged and having the proper controls so that the operator may face each transfer device while operating the controls for that particular transfer device and thereby properly position the carriage and manipulate the transfer mechanism to deposit and remove vehicles from a particular stall as desired.

The invention in its broader aspects is not limited to the specific mechanism shown and described but departures may be made therefrom, within the scope of the accompanying claim, without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

An automobile parking faciilty comprising a multistory structure providing two banks of stalls horizontally spaced a distance slightly greater than the length of a standard passenger automobile with each bank comprising numerous vertically spaced floors each of which has numerous storage stalls in side by side relation, an elevator in said space for conveying vehicles to and from said stalls, a stationary frame forming part of said structure for guiding said elevator, said elevator including a horizontally disposed platform mounted in said frame for vertical movement and extending longitudinally of the space with the length of the platform being sufficient to extend past numerous of the side by side stalls, and with the width being sufficient to accommodate a standard passenger automobile thereacross, a carriage mounted on said platform and guided for movement lengthwise thereof from one end to the other, means for effecting such movement, said carriage being adapted to receive vehicles thereon transversely of the platform with the dimension of the carriage corresponding with the longitudinal dimension of the platform being generally equal to the width of three storage stalls and the reciprocal movement of the carriage along the platform being at least equal to the width of several storage stalls, a pair of transfer devices mounted on said carriage and movable transversely of the platform to and from the carriage and stalls for transferring vehicles to and from the elevator and stalls, said transfer devices occupying positions on the carriage transversely of the platform corresponding to the outer two of three storage stalls in side by side relation, means for effecting such movement of the transfer device, and a control center on the carriage intermediate the transfer device including means to control operation of the transfer devices.

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