United States Patent [19]

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[11] **3,756,432**

[45] **Sept. 4, 1973**

[54] **MECHANIZED PARKING SYSTEM**

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[22] Filed: **Aug. 5, 1971**

[21] Appl. No.: **169,310**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 28,629, April 15, 1970, abandoned.

[52] **U.S. Cl.** ..... **214/16.1 CF**, 74/221, 74/228, 198/102

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

[58] **Field of Search** ..... 214/16.1 CF; 74/221, 74/228

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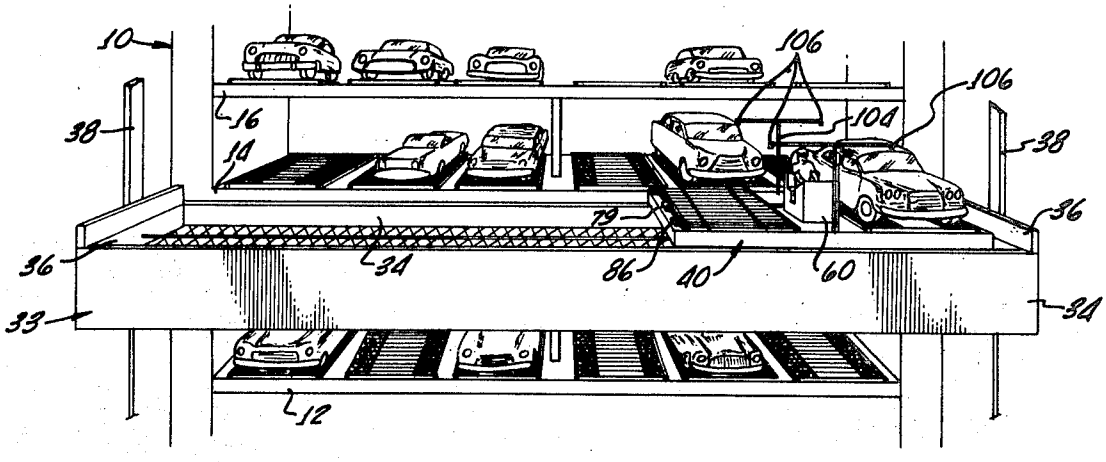
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[57] **ABSTRACT**

In a multi-story building a platform elevator extends across a series of side by side parking stalls located on both sides of the elevator. A vehicle transporter is mounted on rails on the elevator to be moved and aligned with the parking stalls. Motor driven belts define a pair of vehicle receiving spaces on the transporter to be aligned with similar roller driven belts defining space in the parking stalls. The belt drive means on the transporter is connected through a clutch to drive the aligned belts in a parking stall. In another embodiment the drive means is connected by a pivoted frame carrying gears supporting a drive chain.

8 Claims, 10 Drawing Figures



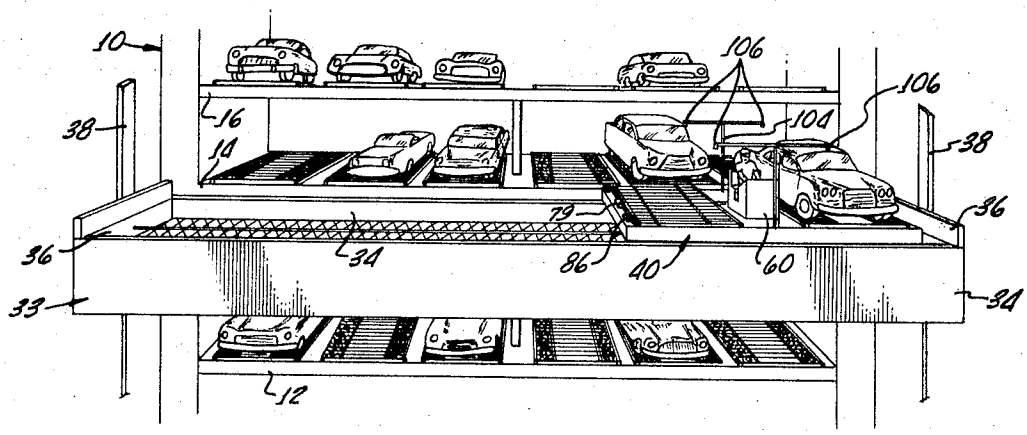
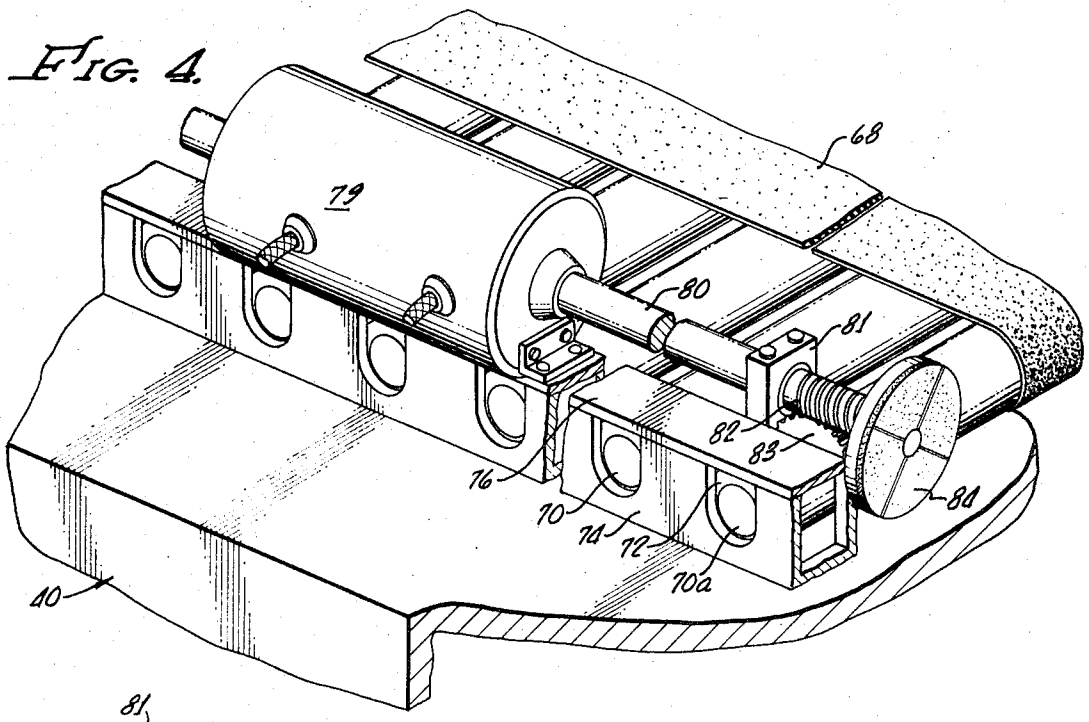


FIG. 1.

FIG. 4.



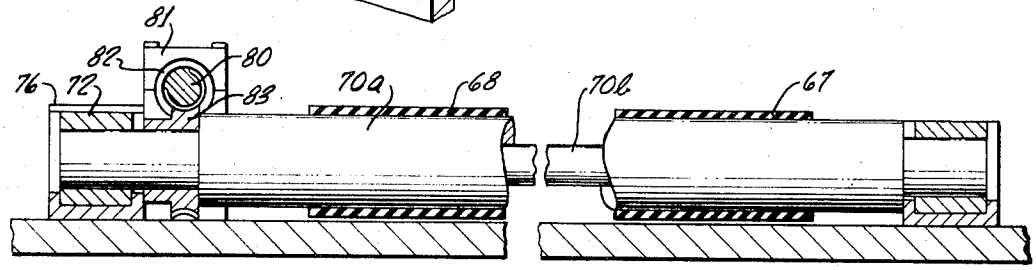
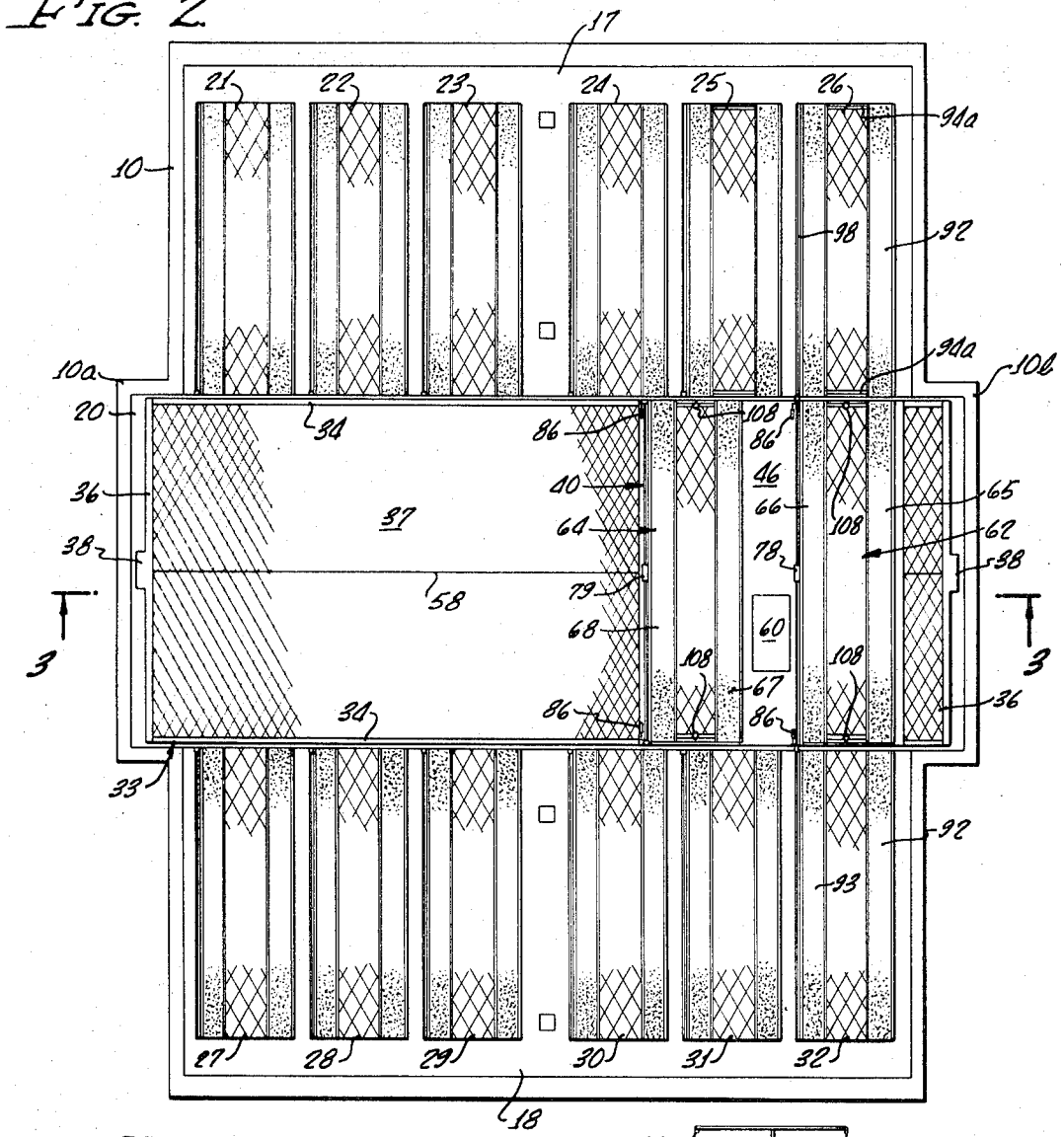


FIG. 5.

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FIG. 2.



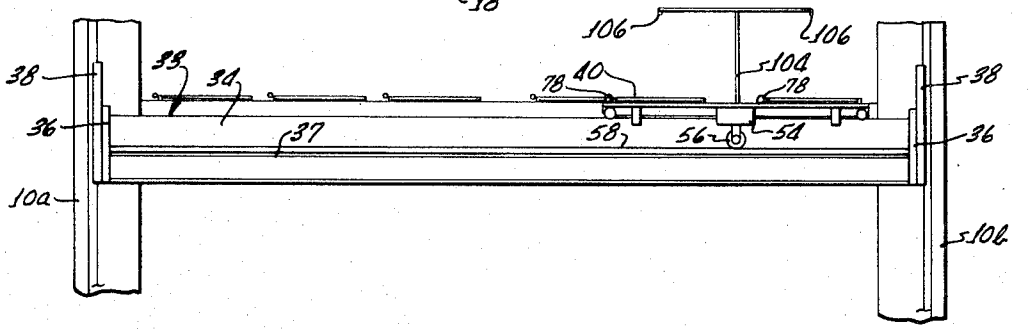


FIG. 3.

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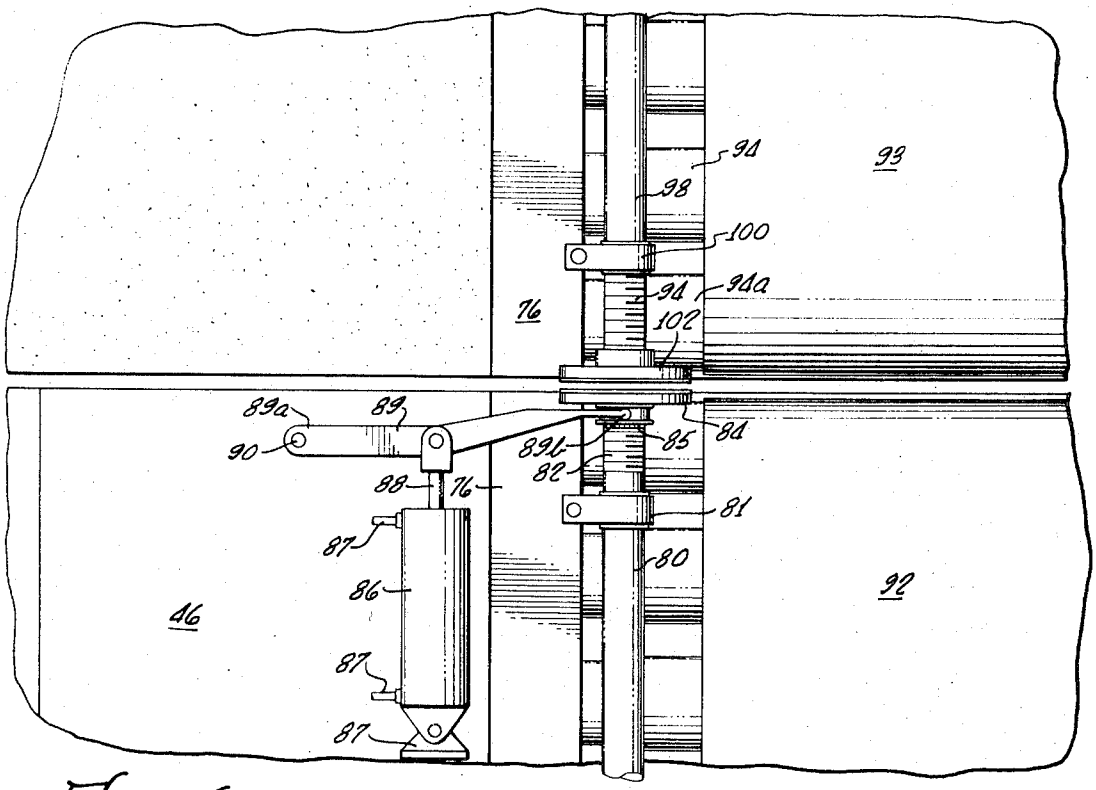


FIG. 6.

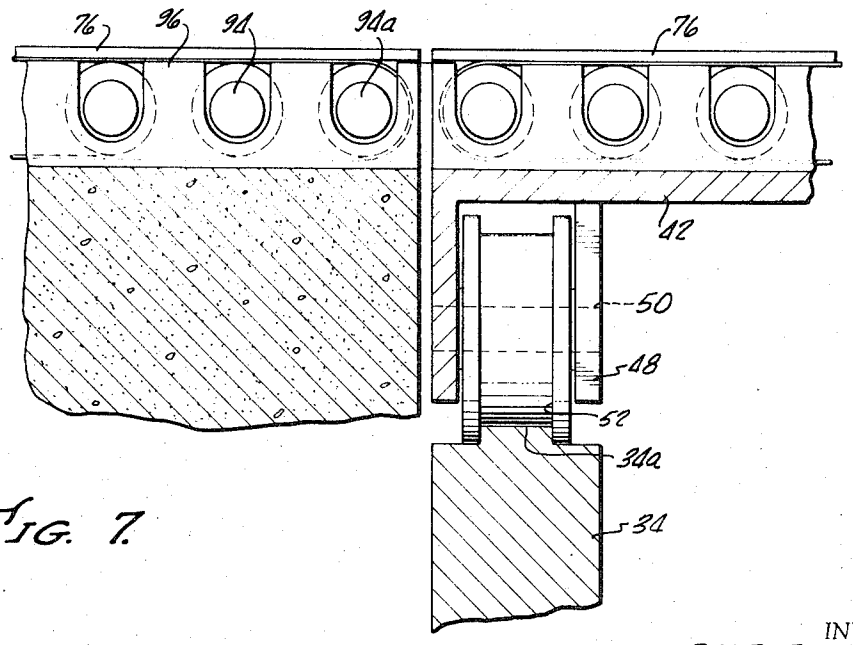


FIG. 7.

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FIG. 8.

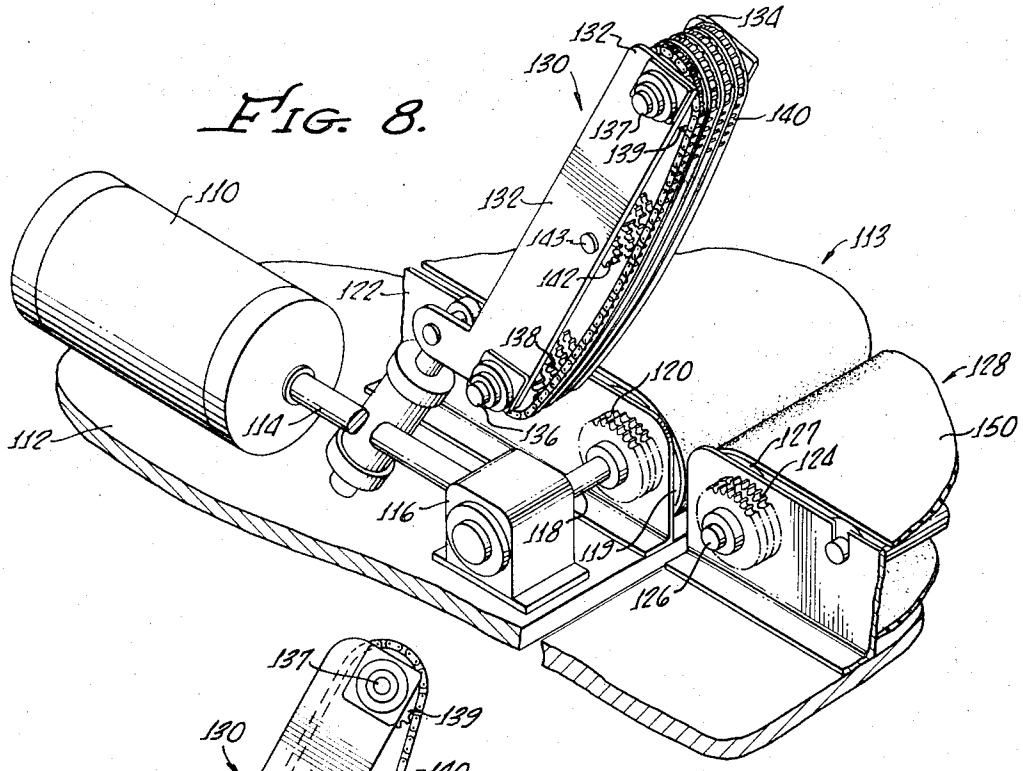
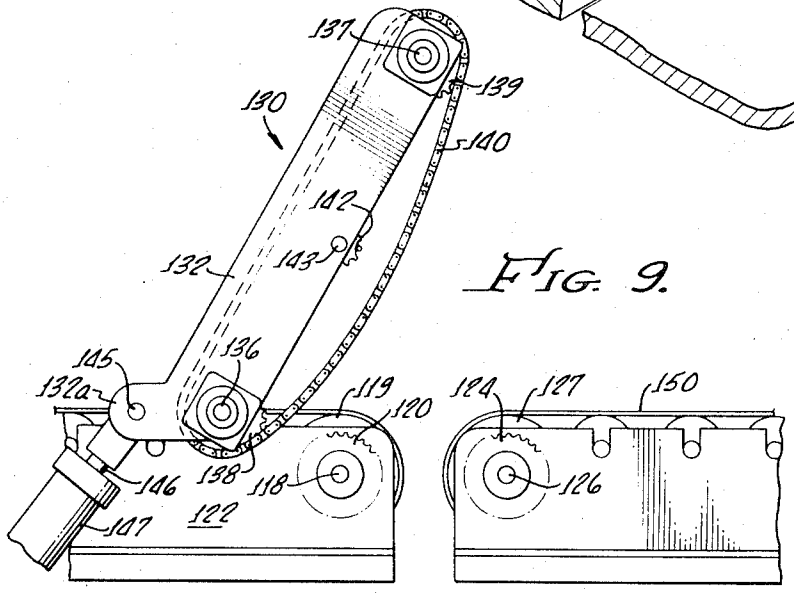


FIG. 9.



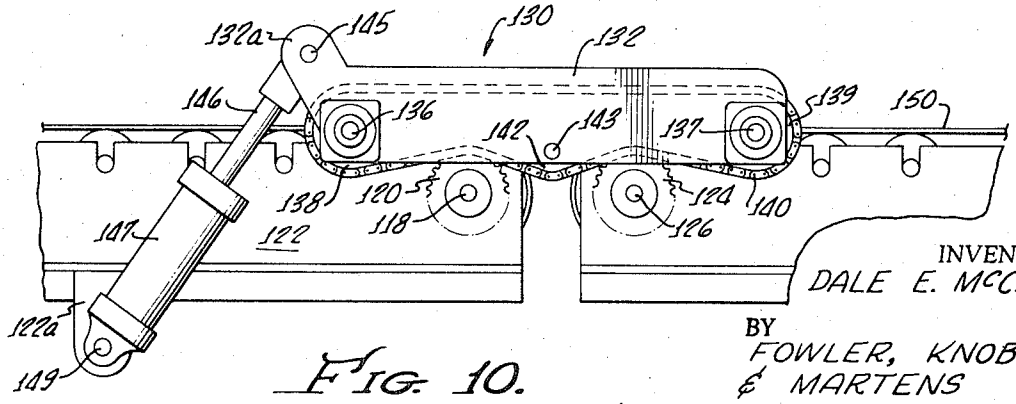


FIG. 10.

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MECHANIZED PARKING SYSTEM

This application is a continuation-in-part of an application entitled "Automated Parking system," Ser. No. 28,629, filed Apr. 15, 1970, now abandoned. The invention relates to an improved mechanized parking system for conveniently storing vehicles particularly in multi-story buildings.

There have been numerous attempts at developing a commercially successful mechanized vehicle parking and storage system, and many systems are disclosed in the patent literature. However, for a variety of reasons, such systems have never become completely practical or particularly well accepted.

One type of system which is currently in operation and has enjoyed a degree of success has a serious shortcoming. In this system and similar ones illustrated in the patent art, vehicles are physically lifted by means of apparatus which engages the undercarriage of the vehicle. The lifting involved often results in damage to the underside of the vehicle and of course, a considerable amount of work is expended in such operations.

Various systems employing rollers, belts or other moving arrangements have also been developed which avoid the lifting objection, but again, none have been particularly successful, the primary reasons for this apparently being either that the systems are too complex, or too costly.

Accordingly, a need still exists for a simple and convenient mechanized vehicle parking and storage system which avoids some of the foregoing objections and is highly suited for use in business centers where land prices are such that multi-story parking facilities must be employed.

Briefly stated, the invention includes vehicle parking areas on several floors of a building on opposite sides of a central elevator area which spans the width of the parking areas. Each parking area is provided with a group of parking stalls arranged in side by side relation, each stall being dimensioned to receive a vehicle with an end of the vehicle being adjacent the elevator area. A platform elevator spans the width of a group of stalls in each parking area so that it is open to both areas on a single floor at one time. The elevator dimension extending between the parking areas is sufficient to receive the length of a vehicle. A vehicle transporter is mounted on the elevator for movement along the length of the elevator so that a vehicle carried by the elevator can be positioned directly in front of a parking stall. Means are provided on the transport for moving a vehicle endwise into one of the stalls and similar means are provided in each of the stalls for moving a vehicle endwise onto the transporter, both without lifting the vehicle.

In a preferred form of the invention, the transporter mounted on the elevator includes spaces for receiving two vehicles at one time with an operator positioned between the two vehicles for operating the controls that will move the vehicles onto and off of the elevator. The means for moving the vehicles comprises a power driven belt supported on rollers with the vehicles resting on the belts. Thus, a vehicle may be positioned on the transporter on the elevator with the brake set and the car locked if desired. The operator of the system can then move the vehicle from the transporter into a parking stall which is also provided with a belt mounted or supported on rollers. A mechanism mounted on the transporter drivingly connects the power source driving

the belt on the transporter to a belt in the parking stall so that a single source may be used to drive the transporter belt and the belt within the stall.

In a preferred arrangement, power is transmitted to the parking stall belt by means of a chain driven by gears mounted on a frame which is pivotable into engagement with gears on the ends of the transporter and the stall belt rollers. Another arrangement employs a clutch mechanism.

Further features and advantages of the invention will be understood by reference to the following detailed description and drawings in which:

FIG. 1 is a perspective view of the interior of a multistory building employing the vehicle parking and storage system of the invention;

FIG. 2 is a plan view of a single floor of the parking building of FIG. 1;

FIG. 3 is a cross-sectional view on line 3—3 of FIG. 2 illustrating the construction of the elevator and the transporter mounted on the elevator;

FIG. 4 is an enlarged perspective view illustrating the drive means used for moving automobiles onto and off of the elevator transporter;

FIG. 5 is a cross-sectional view of a portion of the transporter illustrating an end roller and its drive connection;

FIG. 6 is a plan view of the means for operating a clutch which connects the drive arrangement on the transporter with a drive shaft in the parking stalls;

FIG. 7 is a cross-sectional view of the edge of the transporter, elevator and the entry to a parking stall taken on line 7—7 of FIG. 2 illustrating the support system for the transporter and the spacing of the rollers;

FIG. 8 is a perspective view of an alternate arrangement for transmitting power from the transporter to drive the stall belts;

FIG. 9 is a side elevational view of the arrangement of FIG. 8 with the drive mechanism shown in an inoperative position; and

FIG. 10 is a side elevation view of the mechanism of FIG. 9 showing the structure in an operative position.

Referring first to FIGS. 1, 2 and 3, the automated parking system of the invention is installed in a multistory building 10 having a plurality of floors 12, 14 and 16, each having a pair of parking or vehicle storage areas 17 and 18 on opposite sides of a central elevator area 20. As shown, parking area 17 is formed with six vehicle parking or storage stalls 21–26 and the area 18 is formed with six similar parking stalls 27–32. Each floor is similarly constructed to provide six parking stalls on each side of the central area. As can be seen, the entire area of a floor in the building 10 is utilized by the parking stall areas and the central elevator area. On the bottom floor (not shown) of the building a portion of the building side wall is provided with an opening to permit access directly to one or more of the parking stalls 21–32 so that a vehicle may be directly driven into a parking stall or moved in on a roller system.

As can be seen from FIG. 2, the portions of the building walls 10a and 10b defining the ends of the elevator area 20 extend slightly beyond the width of the building utilized by the side parking areas 17 and 18. Within this elevator area is positioned a platform elevator 33 which essentially fills the elevator area and hence extends completely across the width of the parking areas. The platform elevator 33 includes side beams 34 joined at their ends by end beams 36. If necessary the side beams

may be further connected by other cross beams (not shown). A grille **37** covers the entire area of the elevator between the side and end beams. The platform elevator **33** is supported by a pair of vertically extending risers **38** attached to the end beams **36** and connected at their upper ends to suitable cables (not shown) in a conventional manner. The width of the platform elevator **33**, that is, the dimension between the two parking areas **17** and **18** is preferably about **21** feet which is sufficient to accommodate the length of the largest U. S.passenger car S. passenger to be encountered. Similarly, the width of the parking areas **17** and **18**, that is, the length of the parking stalls **21–32**, is sufficient to accommodate passenger vehicles of this same size.

A vehicle transporter **40** shown mounted on the elevator **33** includes a rectangular frame formed by side member **42**, end members **44**, a central floor **46**, and other suitable cross members (not shown). Referring to FIG. **7**, the side members **42** are formed with a pair of depending lugs or flanges **48**. An axle **50** extends between the lugs **48** rotatably supporting a flanged wheel **52** which rides upon a rail **34***a* formed along the upper edge of the side beam **34**. The other side beam **34** has a similar rail, and four wheels **52** are provided on each side of the transporter **40**.

Referring to FIG. **3**, a variable speed motor **54** or other suitable powering device is positioned on the lower side of the transporter driving a spool **56** which has wrapped around it a tow line **58** having its opposite ends attached to the end beams **38** such that by operating the motor to rotate the drum, the transporter may be moved along the elevator rails by means of the tow line **58** and the motor driven spool **56**. Controls for operating the motor **54** for moving the transporter along the rails **34**a of the elevator are connected to an operator station **60** positioned on the central floor **46** of the transporter **40** so that an operator can sit at this station and move the transporter.

Still referring to FIGS. **1, 2** and **3**, the transporter **40** is provided with a pair of vehicle receiving spaces **62** and **64** on opposite sides of the operator station **60**. Each space is defined by a pair of continuous belts **65** and **66** and **67** and **68** spaced to receive the wheels of a vehicle. Referring to FIG. **4** the belts are supported on a plurality of rollers **70** supported in side by side relation in suitable bearings **72** supported in a suitable bearing support box **74** mounted on the transporter. A bearing cap **76** covers the top of the support box **74**. The belts **65–68** extend across the entire width of the transporter which is the width of the elevator, such that the ends of the belt are positioned close to the end of the belts in the adjacent parking stalls **25, 26, 31** and **32**, as viewed in FIG. **2**.

Each of the vehicle receiving spaces **62** and **64** on the transporter is provided with a reversible variable speed motor **78** and **79** mounted on a bearing box **74** and located near the midpoint of the continuous belts **66** and **68**. The end rollers **70***a* on the transporter include a shaft **70***b* which extends across the width of the car receiving space as shown in FIG. **5**, thus supporting both belts for a given space; however, the other rollers are shorter and extend only beneath a single belt. The other ends of these short rollers are supported in the same manner as the roller ends shown in FIG. **5**.

The motors **78** and **79** and their drive arrangements are identical and hence only one is shown and discussed in detail. Referring to FIGS. **4** and **5**, the motor **79** has a drive shaft **80** extending out both ends of the motor and terminating adjacent the edges of the transporter. A suitable bearing **81** supports the shaft. The outer ends of this shaft are formed with threads which form a worm gear **82**. The end roller **70***a* on the transporter is provided with a gear **83** adjacent the bearing support **72** for the end rollers, which gear **83** is driven by the worm gear on the motor drive shaft **80**. Thus, rotation of the motor output shaft is transmitted through the worm gear and the gear to drive the end roller **70***a*. Rotation of the roller **70***a* in turn drives both the belts **67** and **68** mounted on the roller. Reversing the motor, of course, reverses the direction of the belt.

Referring to FIGS. **2** and **7**, each of the parking stalls **21–32** includes a pair of belts **92** and **93** defining tracks for the vehicle wheels with the belts being mounted on a plurality of rollers **94** mounted in suitable bearing supports **96**.

The belts **92** and **93** are constructed and supported similar to that of the transporter belt **68** as illustrated in FIG. **4** with the exception that drive motors are not provided for each use of the parking stalls. The end rollers **94***a*, FIGS. **2, 6** and **7**, for each stall are, however, provided with gears (not shown) similar to the gear **83** on the transporter and roller **70***a*. A shaft **98** having a worm gear **99** formed on each end is supported by suitable bearing supports **100** in the parking stall **26**, and extends along the entire length of the belt **93**. The worm gear **99** drivingly engages the roller gear to rotate the roller **94***a*.

Referring to FIG. **6**, on the outer end of the drive shaft **80** on the transporter adjacent the worm gear **82** is a clutch plate **84** having a hub **84***a* which is internally splined to mating splines **85** on the end of the shaft so that the clutch plate is axially movable with respect to the shaft. A fluid driven actuator **86** having one end pivotably attached to a bracket **87** mounted on the transporter floor **46**, has an output shaft **88** pivotally attached to a central portion of a linking arm **89**. One end **89***a* of the arm is pivotally attached by a pin **90** to the transporter floor **46** while the other end **89***b* forms a yoke which fits within an annular groove on the hub **84***a* of the clutch plate **84**.

Positioned on the end of the shaft **98** in the parking stall **26** adjacent the elevator area is a clutch plate **102** which mates with the clutch plate **84** formed on the end of the shaft **80** on the transporter. The rotation of the shaft **80** and its clutch plate **84** will rotate the clutch plate **102** and its shaft **98**. This in turn will cause the rollers **94** and the belts **92** and **93** to move.

It should be understood that there is one clutch plate **84** of the type shown in FIGS. **4** to **6** on each end of the shafts **80** extending from the two motors **78** and **79** on the transporter. Also, there is a clutch actuator **86** of the type shown in FIG. **6** adjacent each clutch plate **84**, although for purposes of drawing simplicity such an actuator is not shown in FIG. **4**. Similarly, there is one clutch plate **102** of the type shown in FIG. **6** for each parking stall **31–32**. Axial movement of the actuator output shaft **88** caused by pressurized fluid provided through conduits **87** from a suitable source will move the linking arm **89** causing the clutch plate **84** to be moved axially.

Referring to FIGS. **1** and **3**, there is provided a pair of T-shaped frames **104** supported on opposite ends of the transporter adjacent the parking stalls, mounted on the arms of these supporting frames are light sources

106 directed along the edge of the transporter to be received by suitable photoelectric cells 108. The cells are connected to provide a signal which indicates that a vehicle has passed the transporter edge.

Based on the foregoing description, the operation of the automated parking system in the invention is probably apparent. However, its use will be summarized at this point. As mentioned above, vehicles can be driven directly on to one or more of the parking stalls 21–32 on the first floor of the building. The brake of the vehicle can be set, and the vehicle can be locked if desired. As another approach, a roller supported and driven receiving belt exterior to the main building can be provided on ground level where the owner of the vehicle can park his car and leave it. The belt can then be operated to move the car forward into one of the parking stalls 21–32.

An operator sitting at the operator station 60 on the transporter then energizes the motor 54 beneath the transporter to rotate the spool 56 and move the transporter along the rails 34*a* to a position where a pair of roller supported belts are aligned with a pair of roller supported belts of a parking stall. For example, in FIG. 2, the belts 66 and 65 on the transporter are aligned with the belts 93 and 92 in the stalls 26 and 32. The belts should be carefully aligned so that the clutch plate 84 on the transporter is axially aligned with the mating clutch plate 102 on the parking stall. Suitable signaling or guide means may be employed to facilitate this operation.

Once aligned, the operator energizes the actuator 86 so that its output shaft 88 moves outwardly to move the clutch plate 84 on the transporter into engagement with the clutch plate 102 on the parking stall shaft 98. The operator then energizes the motor 78 on the transporter for driving the transporter end rollers 70*a* through the worm gears 82 and the roller gears 83 which causes the belts 65 and 66 to move. The motor 78, of course, must be energized correctly to operate the belt in the proper direction. Rotation of the motor shaft 80 on the transporter also drives the shaft 98 on the particular parking stall by means of the clutch, thus causing the belt in the parking stall to move. Thus, if a vehicle is positioend in a parking stall on the first floor of the building, it may be moved forwardly onto the belts 66 and 67 of the vehicle receiving space 65 on the transporter. Since two receiving spaces are formed on the transporter, another vehicle can also be moved onto the space 64 of the transporter.

Once the vehicles are completely on the transporter, the photoelectric means 108 signals the operator to stop movement of the belts, or the motor 78 and 79 can be automatically stopped through suitable connections. The operator then operates the elevator 33 to raise the elevator to the desired floor. When the proper floor is reached, the operator aligns the transporter with an open parking stall. If the operator knowns in which parking stall the car is to be parked, he can operate the motor to drive the transporter transversely along the elevator platform while the elevator is rising so as to align the transporter with the parking stall and thus save some time.

The clutch plate 84 on the transporter 40 for the space in which the vehicle is positioned is once more actuated so that it is connected to the clutch plate 102 to drive the end rollers 94*a* of the parking stall. Then, by once more energizing the motor 78 which drives the rollers 70*a*, the belts on the transporter and the parking stall together move the vehicle into its parking stall. The clutch actuator 86 is then actuated to retract its shaft 88 to separate the clutch plates and the operator can once more move the transporter and the elevator to its next assignment. When a vehicle is to be taken from its parking stall and returned to the ground floor, the procedure is simply reversed.

Refer now to FIGS. 8, 9 and 10 for a description of an alternate means for driving the parking stall belts. As can be seen, a motor 110 is mounted on the platform 112 of the transporter 113 with its output shaft 114 extending into a gearbox 116. The gearbox 116 transmits power to a shaft 118 of the end roller 119 on the transporter to drive a pair of spur gears 120 mounted on the roller shaft 118 adjacent to the roller support frame 122. A similar pair of gears 124 are mounted on the shaft 126 of the end roller 127 in the aligned adjacent parking stall 128.

In accordance with this embodiment of the invention a pivotable drive transmitting assembly 130 is provided for driving the parking stall end roller 127. The assembly 130 incluces a pair of spaced side frame members 132 and 134. These members are joined by a pair of stub shafts 136 and 137 mounted on opposite ends of the side frame members. One end of the shaft 136 is further mounted on the frame member 122 on the transporter 133. An additional plate (not shown) may be attached to the platform 112 to support the other end of the shaft 136. Four spur gears 138 are mounted on the shaft 136 between the frame members 132 and 134, and four similar spur gears 139 are mounted on the shaft 137. Four chains 140 are mounted respectively on the four pairs of gears 138 and 139. A series of four idler gears 142 are mounted on a shaft 143 supported by the side frame members 132 and 134 and located near the midsection of the frame members between the end gears 138 and 139.

The frame members 132 and 134 are each provided with an extension one of which is seen in the drawing at 132*a*, adjacent the shaft 136. The extension 132*a* is attached by a pivot pin 145 to the output shaft 146 of a hydraulic ram 147 which is pivotally mounted by a pivot pin 149 to an extension 122*a* on the frame member 122.

The operation of the assembly 130 is apparent by reference to FIGS. 9 and 10. When the transporter 113 is being moved along the elevator, the assembly 130 is held in the position shown in FIG. 9 due to the retraction of the output shaft 146 of the ram 147. When it is desired to drive the belts 150 in the parking stall 128, it is only necessary to actuate the ram 147 so that its shaft 146 is extended, thus pivoting the assembly 130 to the position shown in FIG. 10. As can be seen the drive chains 140 engage the gears 120 and 124 on the transporter and the stall end rollers 119 and 127 so that the transporter gears 120 which are driven through the gearbox 116 and the motor 110, are used to drive the gears 124 on the parking stall end roller 127. As can be seen the distance between the end rollers 138 and 139 on the assembly 130 is sufficiently greater than the distance between the transporter and parking stall end roller gears 120 and 124 so that the chains 140 adequately span the end roller gears. Also note that the idler gears 142 are positioned on the frame side members 132 and 134 so that they are placed between the end roller gears 120 and 124 when the assembly 130 is

in the drive position of FIG. **10**. The purpose of the idler gears **142** is to compensate for slack in the chains and to hold the chains **140** in driving engagement with the end roller gears **120** and **124**.

While a single pair of gears on the assembly **130** and a single chain together with single gears on the end rollers would be adequate for an operative system, it is desirable that a plurality of gears and chains be used, as shown, in that this permits the transfer of power even through the transporter end rollers gears **120** may be slightly transversely misaligned with the parking stall roller gears **124**.

What is claimed is:

1. A mechanized parking system for a multi-story building comprising:

a pair of vehicle parking areas on several floors of the building on opposite sides of an elevator area spanning the width of the parking areas, each parking area having a plurality of parking stalls arranged in side by side relation each stall being dimensioned to receive a single vehicle with an end of the vehicle being adjacent the elevator area;

a platform elevator spanning the width of said parking areas, the elevator dimension extending between said pair of parking areas being just sufficient to receive the length of the vehicle;

a vehicle transporter mounted on said elevator for movement along the length of the elevator so that a vehicle carried by the transporter can be positioned directly in front of the parking stalls in each of the parking areas;

means on said transporter for supporting a vehicle with its ends facing the parking stalls and means for moving a vehicle endwise into one of said stalls;

means in each of said stalls for moving a vehicle endwise onto the transporter;

said means on said transporter for moving a vehicle comprises a pair of belts rotatably mounted on rollers and spaced to receive the wheels of a vehicle, and motor means drivingly connected to rotate the end rollers;

said means for moving a vehicle in each of said stalls includes a pair of endless belts defining a vehicle receiving space, a plurality of rollers supporting the belts including an end roller adjacent the elevator, a gear mounted on the end roller on the transporter and on the end roller adjacent the elevator in each stall, and an assembly for interconnecting said roller gears to drive the stall belts, comprising:

a frame pivotally mounted on said transporter adjacent the end roller, a pair of gears rotatably supported on the frame on axes parallel with said adjacent end roller, the assembly gears being radially aligned with said transporter gear, and the distance between said assembly gears being greater than that between said roller gears, a chain loop mounted on said assembly gears, and means for pivoting said frame so that the chain is moved into and out of driving engagement with the roller gears so that the stall belts are driven by the chain.

2. The structure of claim **1** including an idler gear mounted on said frame within the interior of the chain loop adjacent the side of the frame which is closest to said roller gears when the assembly is pivoted into operational position, and the idler gears further being located so that it is between said roller gears when the assembly is pivoted into position whereby the idler assists in holding the chain in contract with the gears on the rollers.

3. Vehicle parking apparatus comprising:

an elevator;

means defining parking stalls adjacent the elevator;

a vehicle transporter mounted on the elevator having power driven roller means for moving a vehicle into a parking stall including an end roller adjacent the parking stall;

roller means in said parking stall for movably supporting the vehicle including an end roller adjacent the elevator;

a gear mounted on said end roller on the transporter and a gear mounted on said end roller in the aligned parking stall adjacent the transporter;

a frame supporting a pair of spaced gears interconnected by a chain, means for movably mounting the frame on the transporter adjacent the transporter end roller; and

means for moving the frame in a manner such that the chain can be moved into or out of driving engagement with said gears on the end rollers so as to move a vehicle into the parking stall or onto the elevator from the stall.

4. The apparatus of claim **3** wherein the gears on the frame and the gears on the rollers are all in approximately the same plane and the gears on the frame are spaced from each other a distance further than the distance between the gears on the end rollers so that the gears on the end rollers engage a portion of the chain between the gears on the frame.

5. The apparatus of claim **3** wherein said frame is mounted for pivotal movement, and said means for moving the frame pivots the frame so that the chain is moved into engagement with the gears on the end rollers and holds the chain in this position while the stall end roller is being driven.

6. The apparatus of claim **3** including one or more additional gears mounted side by side with each of said gears on the frame, and a corresponding number of additional chains mounted on said additional gears so that the stall gear can be driven even when the transporter end roller gear is slightly transversely misaligned with the stall roller gear.

7. The apparatus of claim **3** wherein said frame is pivotally mounted and including an idler gear mounted on the frame on an axis parallel to and midway between the other two gears on the frame, the gears on the frame being positioned so that when the frame is pivoted to cause the chain to engage the gears on the end rollers, the transporter end roller gear engages the chain between the idler gear and the gear on the frame closest to the frame pivotal axis, and the gear on the parking stall end roller engages the chain between the idler and the gear on the frame which is furthest from the frame pivotal axis, whereby the idler gear helps to hold the chain in engagement with the gears on the end rollers.

8. The apparatus of claim **7** wherein said frame comprises a pair of spaced side members connected by two spaced parallel stub shafts on which said two frame gears are mounted, one of said shafts forming the pivotal axis for the frame, and including extension means formed on one of said frame members for connection to said means for pivoting the frame.

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