July 19, 1960 C. KROLL ET AL 2,945,604

TRANSFERRING APPARATUS

Filed Feb. 10, 1958 6 Sheets-Sheet 1

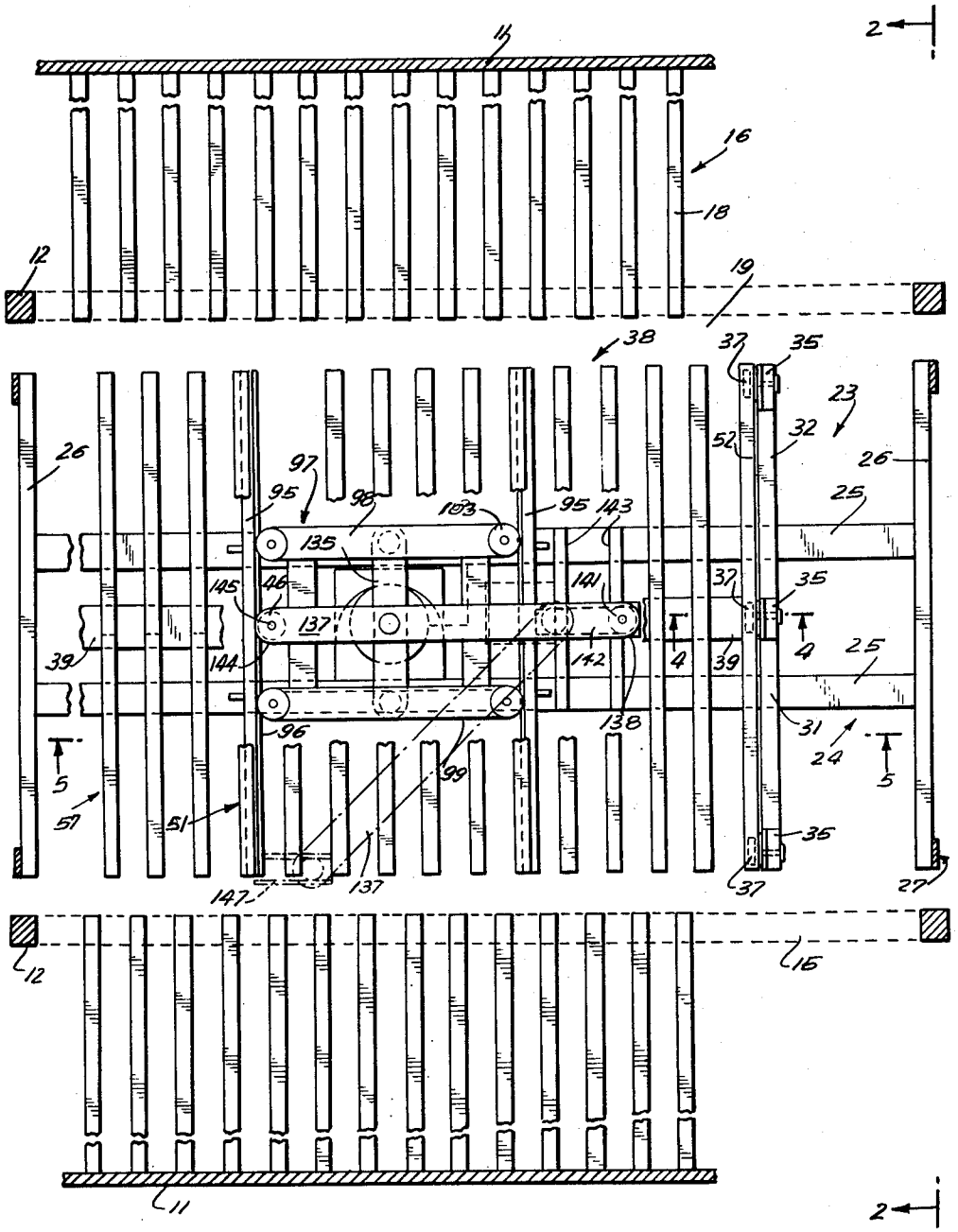

FIG. 1

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TRANSFERRING APPARATUS

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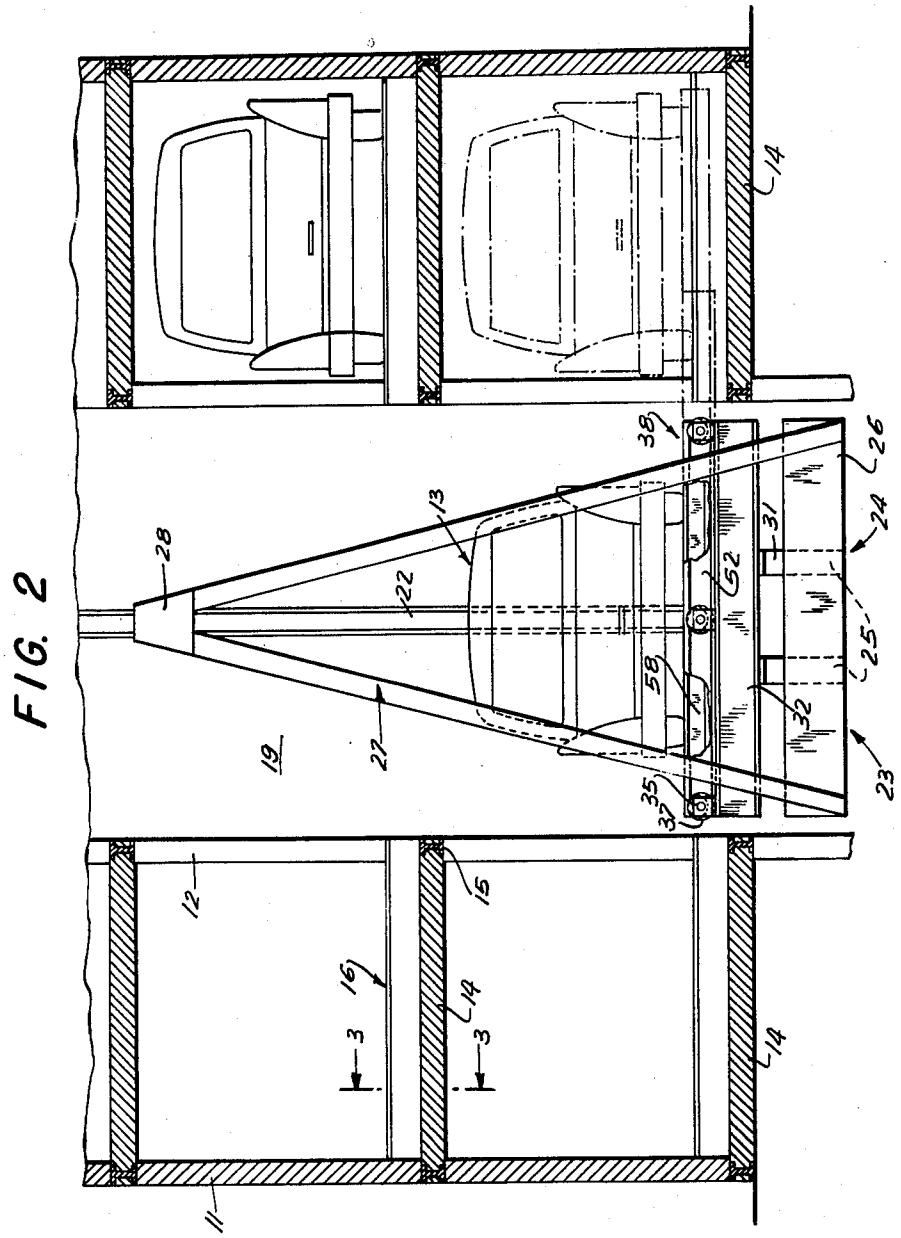

FIG. 2

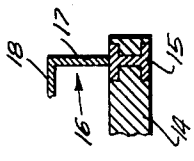

FIG. 3

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FIG. 4

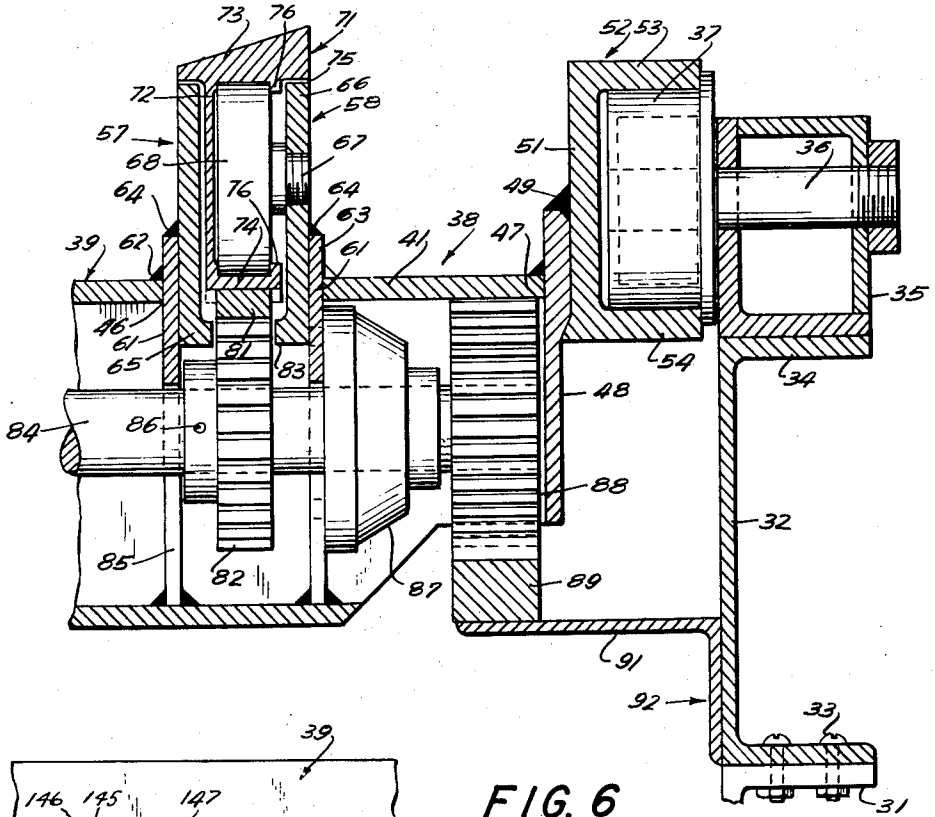
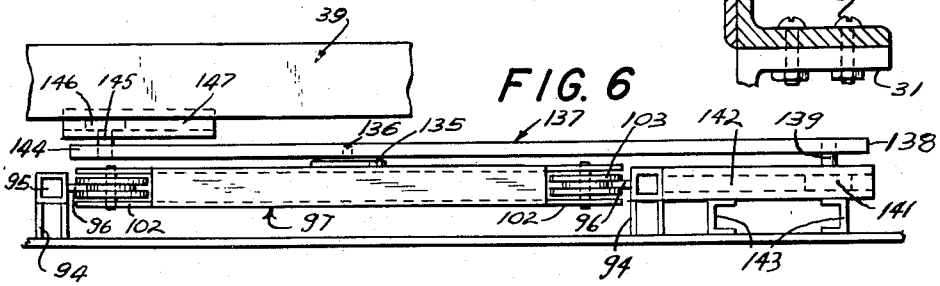


FIG. 6



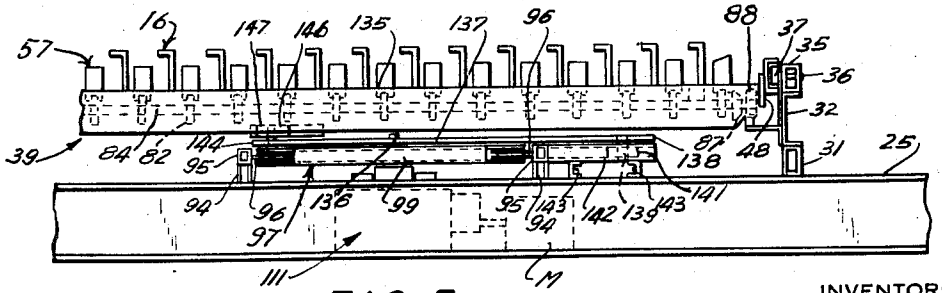


FIG. 5

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FIG. 7

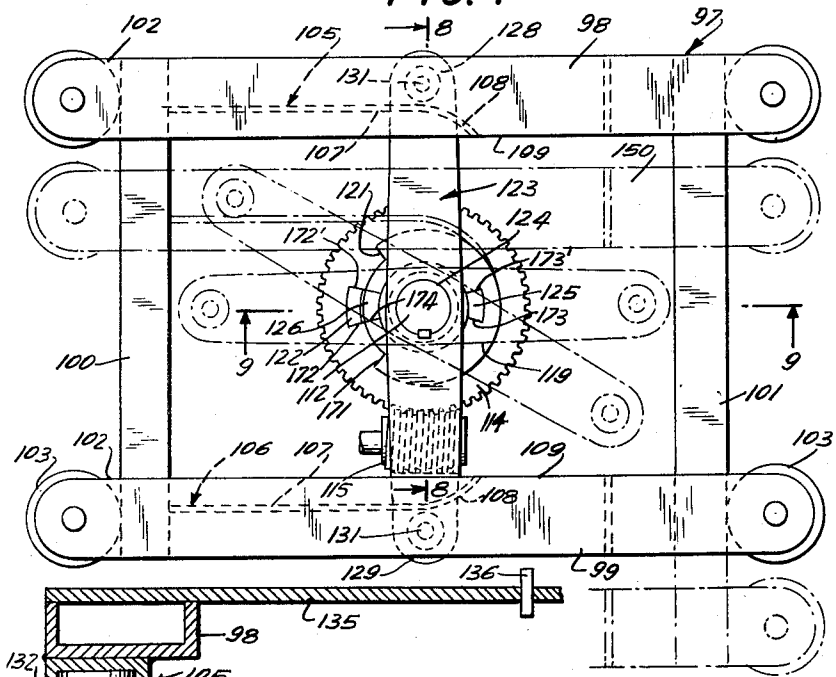

FIG. 8

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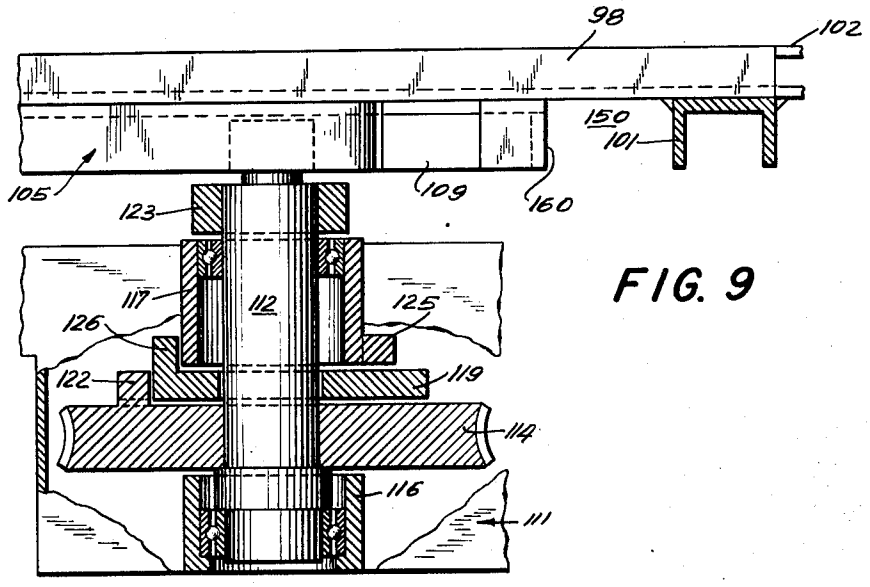


FIG. 9

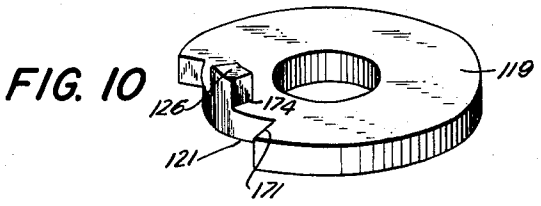


FIG. 10

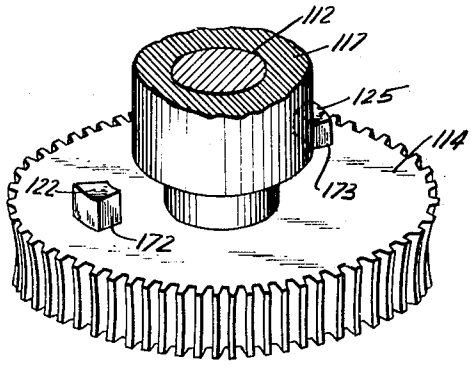
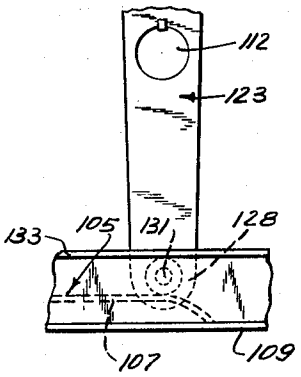


FIG. 11

FIG. 12



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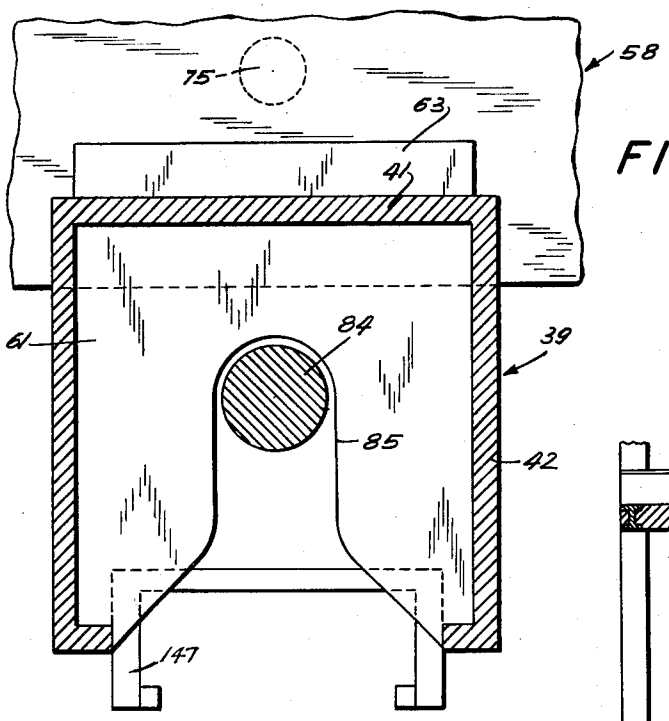

FIG. 13

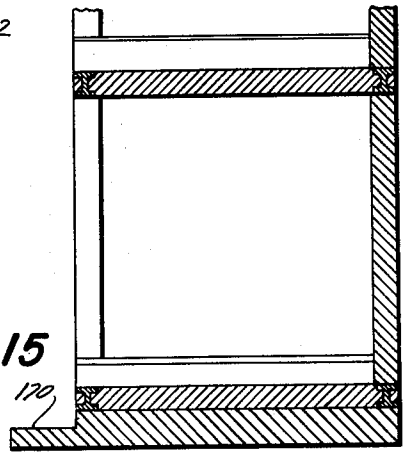

FIG. 15

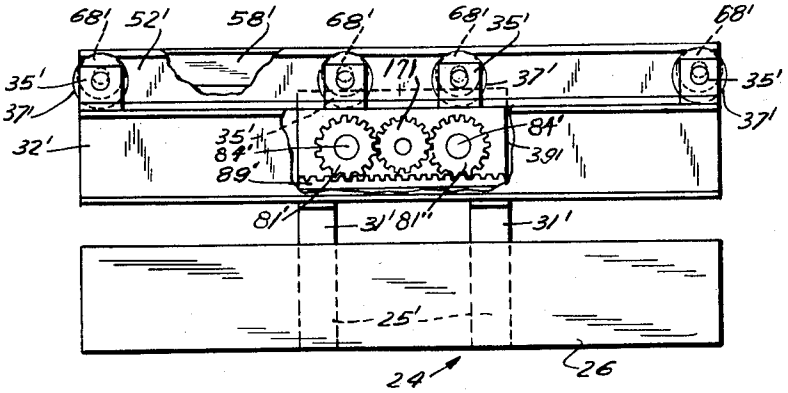

FIG. 14

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United States Patent Office 2,945,604 Patented July 19, 1960

2,945,604

TRANSFERRING APPARATUS

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Filed Feb. 10, 1958, Ser. No. 714,243

10 Claims. (Cl. 214—16.1)

This invention relates to the art of transferring apparatus and more particularly to apparatus for parking automobiles.

As conducive to an understanding of the invention, it is noted that where in conventional multi-story garages, ramps are required to move the automobiles from floor to floor for the parking operation, the number of floors is limited due to the time involved for an attendant to drive the automobile up and down the ramps from floor to floor. Furthermore, the ramps require heavy supporting structure which adds to the cost of the garage.

Where a large number of attendants is required in a busy garage to park the automobiles left by customers and to secure the automobiles for the customers, the cost of operation of the garage is relatively high and such cost is enhanced when the attendants must maneuver the automobiles on the floors of the garage in order to park and remove the same, due to the time required for this operation.

In addition to the foregoing, in a busy garage, as the number of personnel for practical purposes, may not be sufficient to handle peak period loads and also due to the limitations in the number of automobiles that can be accommodated by conventional elevators or ramps in a given period, pile up may occur of waiting automobiles to be parked and of customers waiting for their parked cars.

Such pile up may cause interference with traffic in the adjacent street and annoyance to the customers.

Where automobiles are parked in vertically aligned stalls or on platforms by means of an elevator having a conveyor on which the vehicle is initially positioned and which elevator is moved vertically into substantial alignment with such stalls so that the conveyor may thereon be moved transversely into the stall to deposit the automobile therein and where the supporting structure for the stall necessitates heavy beams that require bulky supports that occupy considerable vertical space, the overall height of the installation will be increased with resultant increase in cost thereof.

Where the conveyor must be moved transversely a considerable distance in order that the automobile be properly positioned in the stall and the drive means to accomplish such movement is movable a relatively great distance to accomplish such movement of the conveyor, the overall system will require considerable space with added cost.

It is accordingly among the objects of the invention to provide an installation of the above type, having a plurality of vertically aligned stalls into which vehicles may respectively be positioned and removed, that is relatively simple in construction and dependable in operation, which by a relatively simple and compact drive means will provide substantial transverse movement of an automobile parked on a conveyor into any of the stalls positioned transversely of the original position of the conveyor so that a relatively large number of vehicles may be accommodated in a minimum of space and will, with the use of a relatively simple control system, provide automatic and rapid parking of automobiles without need for an attendant in the vehicle or the need for manual choking of the vehicle or locking of its brakes and without the need for jacks or the like to raise the weight of the automobile off its wheels or the need for ramps and heavy floors, ceilings and walls found in conventional garage structures and which will also provide automatic and rapid return of parked automobiles to the customers.

Another object is to provide an installation of the above type which permits vehicles to be parked into and removed from stalls on either side of a central position.

According to one aspect of the invention, a plurality of vertically aligned stalls are provided in a building structure, each having a plurality of parallel troughs and crests which may be formed by spaced parallel beams extending inwardly from the supporting wall of the building and desirably supported at their inner ends by a cross beam which in turn may be supported by the structural vertical columns or beams of the frame of the building in which the stalls are installed. Associated with the stalls is a shaft in which a vertically movable elevator is positioned, the elevator mounting a conveyor movable toward and away from the stalls. The conveyor may comprise a plurality of spaced parallel elongated members, each having a primary member, all of which are joined together and movable in unison toward and away from the stalls and a secondary member, each having an associated drive means. The drive means are connected so that upon movement of the primary members in unison, the secondary members will be individually and simultaneously moved outwardly therefrom and respectively positioned in the troughs between the beams of the stalls, the secondary members entering the troughs above the cross beam connected to the beams of the stall.

This application is a continuation-in-part of co-pending application Serial No. 636,995, filed January 29, 1957.

In the accompanying drawings, in which are shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is a plan view of the installation with parts broken away,

Fig. 2 is a transverse sectional view taken along line 2—2 of Fig. 1,

Fig. 3 is a detail sectional view taken along line 3—3 of Fig. 2,

Fig. 4 is a sectional view taken along line 4—4 of Fig. 1,

Fig. 5 is a view with parts broken away taken along line 5—5 of Fig. 1,

Fig. 6 is a detail view on a larger scale similar to Fig. 5 showing the drive lever and associated structure,

Fig. 7 is a top plan view of a portion of the drive mechanism,

Fig. 8 is a sectional view taken along line 8—8 of Fig. 7,

Fig. 9 is a view similar to Fig. 8 taken along line 9—9 of Fig. 7,

Fig. 10 is a perspective view of the locking ring member,

Fig. 11 is a perspective view of the worm gear,

Fig. 12 is a fragmentary perspective view of the crank bar of Fig. 7 in another position,

Fig. 13 is a transverse sectional view of the conveyor beam,

Fig. 14 is an end view of the elevator with parts broken away according to another embodiment of the invention, and

Fig. 15 is a fragmentary transverse sectional view of the bottom-most stall of the embodiment of Fig. 14.

Referring now to the drawings, as shown in Figs. 1 and 2, the parking installation comprises a building structure having opposed vertical side walls **11** and supporting columns **12** located inwardly of said side walls and spaced by a distance slightly greater than the length of a conventional automobile **13**, the space between each pair of columns **12** defining a stall. Extending laterally inward from each of the side walls **11** are vertically spaced horizontal shelves **14** transversely aligned as shown, with the inner end of each of said shelves **14** having a horizontal structural beam **15** supported by the columns **12**.

Positioned on each of the shelves **13** and extending at right angles to the side walls **11** are a plurality of beams **16**, each illustratively L-shaped in cross section as shown in Fig. 3, having the lower edge of its vertical leg **17** affixed to the shelf **14**, the horizontal legs **18** of the beams **16** being spaced from each other as shown in Fig. 1.

The beams **16** which extend the width of the shelves define troughs and crests and each of the shelves is of sufficient width to support the wheels of the automobile **13** to be positioned thereon in the manner hereinafter to be described.

The vertical space **19** between the aligned columns of shelves **14** defines an elevator shaft which may have a plurality of pairs of transversely aligned vertical guide rails **22** as shown in Fig. 2, each pair to guide an elevator **23** for vertical movement.

As shown in Figs. 1 and 2, the elevator **23** comprises a base structure **24** which may include two parallel spaced beams **25** joined at their respective ends by cross beams **26** to form a rigid rectangular unit. Secured to each of the cross beams **26** at the ends thereof is the base of an A frame **27**, the top of which is guided by the vertical rails **22** which also guide the base structure **24**, the guiding means being suitable rollers (not shown) connected to the upper ends **28** of the A frame and the cross beams **26** of the base member, which rollers ride along the vertical rails **22**. Through suitable cables (not shown) connected to the upper end of the A frame, the elevator may be raised and lowered as desired.

Secured to each of the beams **25** inwardly of each of the ends thereof and rising therefrom is a supporting member **31** (Figs. 1, 2, 4 and 5), and a U-shaped channel beam **32** which extends substantially the width of the elevator shaft **19** is secured to each pair of transversely aligned members **31** as by bolts **33**.

Mounted on the upper end **34** of each of the beams **32** is a plurality of supports **35**, illustratively three in number, in the embodiment shown, one of said supports being located in the center of each of the beams **32**, and the other two of said supports being at the respective ends of each of said beams. Extending transversely through each of the supports is a stud shaft **36** to the inner end of which is secured a flanged roller **37** as is clearly shown in Fig. 4.

Mounted on the rollers **37** is a conveyor **38** which is movable at right angles to the beams **25**. As shown in Fig. 4 and Fig. 13, the conveyor **38** comprises a beam **39** that is U-shaped in cross section having a top wall **41** and parallel side walls **42**, said top wall **41** having a plurality of spaced parallel slots **46** (Fig. 4) therethrough transversely of the length thereof.

Secured to each of the ends **47** of beam **39** as by welding, is a plate **48** that extends slightly above the top surface of the beam **39**. Secured as by welding, as at **49** to the upper portion of each of the end plates **48** is the side wall **51** of a U-shaped channel beam **52**, the top and bottom walls **53**, **54** of said beam **52** straddling the rollers **37** with the top wall **53** riding on said rollers **37** as is clearly shown in Figs. 1 and 4.

Mounted on the beam **39** and extending at right angles thereto is a plurality of parallel spaced telescoping or elongating units **57** which form part of the conveyor and which support the wheels of the automobile **13**.

Each of the units **57** comprises a primary member **58** (Fig. 4), illustratively a U-shaped beam of length substantially equal to the length of the beam **52**, and of width less than the space between adjacent legs **18** of beams **16** of the stalls so that the members **58** may fit therebetween in the manner hereinafter described. To mount the primary members **58**, each of the slots **46** has extending therethrough a pair of spaced parallel web plates **61** which are secured as by welding as at **62** to the top surface **41** of beam **39** and extends above the latter as at **63**. Each pair of web plates **61** straddles an associated primary member **58** which is secured at its midpoint to the protruding portions **63** of each pair of web plates as by welding at **64**, the cross piece **65** at the lower end of each of the primary members extending below the top surface **41** of the beam **39** as is shown in Fig. 4.

Extending laterally inward from the side wall **66** of each of the primary members **58** is a plurality of stud shafts **67**, illustratively three in number, one of said stud shafts being positioned at the midpoint of the primary member and the other two of said stud shafts being positioned adjacent each of the ends of the primary member. Mounted on each of the stud shafts is a roller **68** which supports a secondary member **71**, illustratively a channel beam of length substantially equal to that of the primary member **58**.

As shown in Fig. 4, the secondary member **71** in cross section has a vertical side wall **72** and opposed parallel top and bottom walls **73** and **74**. The top wall **73** is of width substantially equal to the width of the primary member **58** and is slightly spaced therefrom as at **75**, said top and bottom walls having flanges **76** which, together with the side wall **72** define a track for the rollers **68**.

The top walls **73** of the secondary members **72** at each end of the conveyor are inclined upwardly as shown in Fig. 4 to prevent the automobile from rolling off the conveyor even if its brakes are not locked, and the top walls of the intervening secondary members are in a horizontal plane.

Means are provided to effect movement of the secondary members **71** with respect to the primary members **58** upon movement of the beam **39** on the rollers **37**. To this end, as shown in Fig. 4, a rack **81** is secured to the bottom wall **74** of each of the secondary members **71**, each of said racks being engaged by a gear **82** which extends through an associated slot **83** in the cross piece **65** of each of the primary members **58**.

The gears **82** are secured to a shaft **84** that extends the length of the beam **39** through openings **85** in each of the pairs of web plates **61** as is shown in Figs. 4 and 13, each of said gears **82** being positioned between an associated pair of web plates and secured to the shaft as by set screw **86**.

The ends of the shaft **84** extend through bearings **87** secured to the web plates **61** adjacent each of the ends **47** of the beam **39** and each of the shaft ends has secured thereto a gear **88** that meshes with an associated rack **89** mounted on the inwardly extending horizontal leg **91** of an angle beam **92** that is secured to the beam **32** and extends the length thereof.

Means are provided to effect movement of the conveyor **38** from the central position shown in Figs. 1 and 2 toward and away from the shelves **14**.

To this end, each of the beams **25** inwardly of the supports **31** mounts a pair of supports **94** (Figs. 5 and 6) and a rail **95** (Fig. 1) which is of length substantially the same as that of beam **32** is secured to each pair of transversely aligned supports **94**, said rails being located beneath the beam **39** as is clearly shown in Fig. 6.

Each of the rails **95** has an inwardly extending flange **96** which mount a movable frame **97**. As shown in Figs. 1 and 7, the frame **97** comprises a pair of spaced

parallel cross beams **98**, **99** formed from inverted U-shaped members and extending at right angles to the elongating units **57**. The ends of the cross beams which are closed, are joined by parallel beams **100**, **101** so that the frame will form an integral rectangular unit.

Extending from each end of the beams **98**, **99** is a pair of spaced horizontal brackets **102** between each of which is rotatably mounted on a vertical axis a roller **103** which has flanges that straddle the flanges **96** on the rails **95**. Thus, the frame **97** is supported beneath the beam **39** in manner such that it may freely move along the rails **95**.

Affixed as by welding, as shown in Fig. 8, to the cross beams **98**, **99** respectively, are cross heads **105**, **106**, illustratively inverted U-shaped members. The members **105**, **106** extend from the left member **100**, terminating short of the right member **101** as is clearly shown in Fig. 9. The opposed inner walls **107** of members **105** and **106** taper inwardly as at **108** and each has an opening **109** therethrough, clearly shown in Fig. 9, the purpose of which will be hereinafter described.

Positioned between and secured to the beams **25** and centrally located therealong is a housing **111** which has a vertical shaft **112** rising therefrom as is clearly shown in Fig. 8. Affixed to shaft **112** as by keying at **113** is a worm gear **114** engaged by a worm **115** driven by a motor M also mounted between beams **25**. The housing **111** desirably has sleeves **116** and **117** rigid therewith through which the shaft **112** extends, suitable bearings **118** being positioned in said sleeves rotatably to mount the shaft **112**. Idly mounted on the shaft **112** between the sleeves **116** and **117** is a stop ring member **119** which has an arcuate notch **121** in its periphery, illustratively occupying 100 degrees of arc. The worm gear **114** has on its upper surface a dog **122** which may be formed integral therewith and which illustratively occupies 30 degrees of arc. The dog **122** is positioned in the arcuate notch **121** in the stop ring **119** as is clearly shown in Fig. 7. Affixed to the upper end of shaft **112** extending beyond the upper bearing **118** in sleeve **117** is a crank bar **123**, the latter illustratively having a central opening **124** therein through which the shaft **112** extends, said crank bar **123** being secured to the shaft **112** as by keying. The crank bar **123** is so positioned on the shaft **112** that it will extend at right angles to the center line of the dog **122** rigid with the worm gear **114** as is clearly shown in Fig. 7. With the crank bar **123** so positioned, it will also extend at right angles to a dog **125** affixed as by welding to the sleeve **117** and diametrically opposed to the dog **122** on the gear **114**. The dog **125** on the sleeve **117** also occupies 30 degrees of arc as does a dog **126** affixed to the ring member **119** midway between the ends of arcuate notch **121**.

Each of the ends **128** and **129** of the crank bar **123** has an opening in which is affixed an upstanding pin **131**, the upper end of which illustratively mounts a roller **132** which is positioned between the inner and outer walls **107**, **133** of each of the cross heads **105**, **106** as is clearly shown in Fig. 8.

Means are provided operatively to connect the frame **97** to the beam **39**. To this end, as shown in Figs. 1 and 6 a cross bar **135** extends transversely across the beams **98**, **99** midway between the ends thereof and is secured thereto, said cross bar having an upstanding pin **136** at the center thereof. Pivotally mounted on pin **136** is a lever **137**, the length of the lever on one side of the pin illustratively being twice that on the other side thereof.

As shown in Fig. 6, the end **138** of the longer portion of the lever has a depending stud shaft **139** on which a roller **141** is mounted, said roller riding in a track defined by upstanding legs of a U-shaped channel section **142** centrally located on bars **143** extending transversely across beams **25** and secured thereto.

The end **144** of the shorter portion of lever **137** has an upstanding stud shaft **145** on which a roller **146** is

mounted, said roller riding in a track defined by the depending legs of a U-shaped channel section **147** secured to the beam **39** as shown in Figs. 6 and 13.

In the operation of the equipment with the elevator say at the ground floor level, represented, for example, by the lowermost shelves **14**, as shown in Fig. 2, an automobile is driven at right angles to the beams **16** so that its front and rear wheels will rest on such beams. Thereupon, with the elevator positioned so that the top surfaces of secondary members **71** are slightly below the level of the horizontal legs **18** of beams **16**, the worm **115** is driven by the associated drive motor M to rotate worm gear **114** in say a counterclockwise direction from the position shown in Fig. 7. This will cause rotation of the shaft **112** and the crank bar **123** thereon in a similar direction. As the shaft **112** is rotated in a counterclockwise direction, the roller **132** on pin **131** at the end **128** of crank bar **123** will react against the side wall **107** of cross head **105** tending to move the frame **97** in a downward direction from the position shown in Fig. 7, or to the left referring to Fig. 2, the rollers **103** riding along flanges **96** (Fig. 5). As the frame **97** so moves, inasmuch as the end **129** of the crank bar **123** will also move in a counterclockwise direction, the roller **132** on pin **131** carried thereby will be moved through opening **109** in wall **107** so that such pin is clear of said cross head, as shown in broken lines in Fig. 7, the curved portion **108** of the side wall **107** of cross head **106** providing clearance for the roller for unobstructed movement thereof.

With continued rotation of the crank bar **123**, the rate of travel of the frame **97** will increase rapidly and correspondingly decrease when the crank bar has made 180 degree rotation to effectively provide a sinusoidal rate of travel. Thus, there will be little movement imparted to the frame at the beginning and end of such 180 degree travel. As the crank bar **123** moves through an 180 degree arc, by reason of the downward movement of the frame **97** from the position shown in Fig. 7, the roller **132** on pin **131** at the end **129** of the crank bar **123** will pass through the space **150** defined between the end **160** of the cross head **105** and the right member **101** so that it is completely clear of the cross head **105**.

As the end **138** of lever **137**, which is guided by track section **142**, is restrained from transverse movement with respect to beams **25** and can only move in direction parallel thereto, due to the movement of frame **97**, above described, the lever **137** which is pivoted on pin **136** will rotate in a counterclockwise direction from the neutral position shown in Fig. 1. As a result, the end **144** of lever **137** which is guided by track section **147** mounted on beam **39** will react against said track section.

This force will cause the beam **39**, which through beams **52** rides on rollers **37** supported by the base structure **24**, to move laterally from the neutral position shown or downward, referring to Fig. 1, the rollers **141**, **146** at the ends of the lever **137** riding along the associated track sections **142**, **147** during such movement.

Due to the arrangement of the lever **137** on the frame **97**, with the pin **136** illustratively located so that the distance of the pin **136** from roller **146** is one-third the length of lever **137**, the lateral movement of beam **39** is one and one-half times the stroke of the frame **97** due to the rotation of crank **123**.

As the beam **39** and associated beams **52** are moved on rollers **37**, the gears **88** will ride along fixed rack **89** thereby causing rotation of said gears and the shaft **84** to which they are affixed. Rotation of shaft **84** will in turn cause rotation of the gears **82** affixed thereto, to drive the racks **81** which they engage to effect outward movement of the secondary members **71** which ride on the rollers **68**.

With the gears **82** and **88** having the same diameter, it is apparent that the secondary members will move

twice as fast as the primary members carried by beam 39.

The frame 97 and the lever 137 are designed to move the beam 39 outwardly an amount such that the beams 52 are supported by the roller 37 at one end of beam 32 as well as the central roller 37, and the secondary members are supported by the rollers 68 at one end of the primary member as well as by the central roller 68. Thus, the weight of the automobile 13 will be supported by the rollers which are spaced sufficiently to greatly reduce the cantilever load.

When the secondary members 71 are fully extended, which will occur when the crank bar 123 is rotated 180 degrees in a counterclockwise direction from the full line position shown in Fig. 7, a limit switch may be provided to de-energize the motor M driving shaft 112. As the rate of movement of the frame 97 at such time is extremely slight, there would be little chance for the crank bar 123 to move further than 180 degrees and even if there was any slight additional travel of the crank bar 123 this would have no harmful effect as it only tends to retract the conveyor slightly from its fully extended position.

In the remote contingency that the limit switch (not shown) should cut off erroneously when the pin 131 at the end 128 of crank bar 123 was aligned with opening 109 in cross head 105, which would be in a position several degrees further in a counterclockwise direction from that illustratively shown in Fig. 12, due to the inertia tending to move the frame 97 upwardly at such time due to such over-travel, the frame 97 may move past the pin 131 so that both of the pins 131 would be clear of the associated cross heads, rather than the single pin 131 associated with cross head 106 which is required. In such a contingency the equipment would have to be manually reset. To prevent this over-travel, which is unlikely, the dogs 122, 125 and 126 and the stop ring member 119 are provided.

Thus, referring to Fig. 7, when the crank bar 123 initially starts its movement, the dog 122 carried by worm gear 114 will abut against the end 171 of the arcuate notch 121 thereupon causing the ring member 119 to rotate in a counterclockwise direction from the position shown in Fig. 7.

As the dog 125 mounted on the bushing 117 affixed to the housing is initially diametrically opposed to the dog 122 carried by the worm gear 114, as previously described, and as both of such dogs occupy 30 degrees of arc, it is apparent that the leading edge 172 of dog 122 which engages the end 171 of the arcuate notch 121, which occupies 100 degrees of arc, will become aligned with the edge 173 of the dog 125 affixed to the bushing when the worm gear 114 has rotated 150 degrees. Inasmuch as the arcuate notch 121 occupies 100 degrees of arc and the dog 126 carried by the ring member 119 occupies 30 degrees of arc, the edge 171 of the notch 121 is spaced from the edge 174 of dog 126 by an angle of 35 degrees. Consequently, the worm gear 114 will be able to rotate 35 degrees further before the dog 126 abuts against the fixed dog 125 to restrain further rotation of the worm gear 114.

This restraint of movement after 185 degrees' rotation of the crank bar 123 will prevent movement of the pin 131 carried by end 128 thereof to a position in which it is in alignment with the opening 109 in cross head 105. Hence, there is no likelihood of sufficient over-travel of the frame 97 as previously described to cause the pin 131 carried by end 128 of crank bar 123 to be moved out of the cross head 105 which would interfere with subsequent operation of the equipment and require manual resetting thereon.

At this time, through appropriate controls, the elevator may be raised slightly to cause the outstanding secondary members 71 to rise vertically to lift the automobile from the beams 16.

Thereupon, the motor driving shaft 112 is energized in reverse direction so that the shaft 112 will rotate in a clockwise direction as will the crank bar 123. As the result of such movement, inasmuch as the pin 131 carried by the end 128 of the crank bar 123 is still between the walls 107 and 133 of the cross head 105, it will react against the wall 133 tending to move the frame in an upward direction from the position shown in Fig. 12. This movement of the frame is also sinusoidal in effect being relatively slow at the beginning and end of the 180 degree rotation of the crank bar 123. As the frame 97 moves upwardly, the pin 131 carried by the end 129 of the crank bar 123 will move through the opening 150 between the end of the cross head 105 and the right cross member 101 and through opening 109 in wall 107 of cross head 106 to again be positioned between the side walls 107 and 133 of cross head 106 as shown in Fig. 7.

As the result of the movement of frame 97 back to the neutral position shown in Fig. 1, through the action of lever 137, the conveyor 38 will also be retracted.

The automobile having thus been positioned on the conveyor 38 mounted on the elevator 23 can be raised to a desired floor and deposited into a stall on either side of the elevator shaft 19.

To illustrate the complete operation of the equipment, it will be assumed that the automobile is to be deposited into a stall on the right side of the shaft 19. To this end, with the frame 97 in the neutral position, shown in Fig. 7, and with the elevator at a level such that the tops of secondary members 71 are slightly above the top level of the beams 16 of the right stall, the motor M is energized to drive the shaft 112 in a clockwise direction. Consequently, the roller 132 on pin 131 at the end 129 of crank bar 123 will react against the side wall 107 of cross head 106 to move the frame 97 upwardly from the position shown in Figs. 1 and 7 or to the right, referring to Fig. 2.

As a result, through the drive imparted to beam 39 by lever 137, the beam 37 will move to the right and the secondary members 71 carrying the automobile 13 will be extended between and above the beams 16 of the stall.

The elevator is then lowered slightly to cause the members 71 also to be lowered and thus deposit the automobile on beams 16. The operation of the conveyor moving in this direction and back to neutral position corresponds to the operation previously described and hence will not be repeated.

When the worm gear 114 moves in a clockwise direction, it will also move 150 degrees before the edge 172' of dog 122 thereon is aligned with the edge 173' of dog 125 affixed to the sleeve 117. Thereupon, the ring member 119 will move 35 degrees additionally before the dog 126 thereon abuts against dog 125 to restrain further movement of the worm gear 114 to prevent the pin 131 at end 129 of crank bar 123 moving clear of cross head 106 as previously described with respect to cross head 105.

In the embodiment previously described, the maximum lateral movement of the conveyor 38 is limited in that the beams 52 must be supported by at least two of the rollers 37; i.e., the central roller 37 and the roller 37 at an end of beam 32. In addition, the secondary members 71 must also be supported by at least two of the rollers 68.

In order to provide for further extension of the conveyor 38, say in order to provide additional space at the drive-in level to provide a wider walk for the passenger or attendant driving the car into the bottom-most stall at the drive in level for subsequent removal to a higher stall, the embodiment shown in Figs. 14 and 15 is provided.

This embodiment is substantially identical to the em-

bodiment shown in Figs. 1 to 13 and corresponding elements have the same reference numerals primed.

Referring to Fig. 15, the stalls are identical to those shown in Fig. 2 except that the bottom-most stall at the drive-in level has a walk **170** inwardly thereof which is of height such that the beam **39'** may move thereover.

The beam **39'** (Fig. 14) is of greater width than the beam **39** and carries two shafts **84'** each having a gear **82** which meshes with rack **81**, said shafts **84'** each having a gear **88'**, **88''** secured thereto, which ride on rack **89'** and engage idler gear **171** which is spaced from said rack. The primary member **58'** rotatably mounts four rollers **68'**, one at each end of the primary member and two spaced respectively on each side of the center of said primary member **58'**.

In addition, the beam **32'** also mounts four rollers **37'** aligned respectively with the rollers **68'**.

To provide for additional lateral movement of the conveyor **38**, in the embodiment of Figs. 14 and 15, the beams **98**, **99** of the frame **37** may be spaced wider apart than as shown in Fig. 1 with a longer crank bar **123**, or the lever **137** may be of greater length. In addition, lateral movement of the conveyor **38** can be greater in one direction than the other by changing the position along its length at which the crank bar **123** is connected to shaft **112**.

Due to the greater stroke imparted to the beam **39'** it will move over the walk **170** shown in Fig. 15. As a result the gear **81''** will move past the end of rack **89'**. However, as gear **81'** is still engaging the rack **89'**, drive will still be imparted thereby to the secondary members through idler gear **171** for complete extension thereof.

Although one of the pair of central rollers **37'**, **68'** will move past the end of beam **52'** and primary member **58'** respectively, the beams **52'** and the primary member **58'** will still be supported by the other of the pair of central rollers **37'**, **68'** as well as the rollers **37'** and **68'** at the end of beam **52'** and the primary member **58'**.

By reason of the bi-sinusoidal movement imparted to the frame **97** by the drive mechanism above described, the drive mechanism may be relatively compact, thereby cutting down the size of the installation and in addition, as the conveyor, when retracted onto the elevator, will have very little speed, it is not likely to overshoot and extend sufficiently beyond the edge of the elevator so as to interfere with vertical movement thereof. Any slight overshoot is adequately taken care of by the clearance provided between the inner ends of the stalls and the adjacent edges of the elevator. If desired, a relatively simple brake mechanism could be used to immediately restrain rotation of the shaft **112** upon de-energization of the motor M, for since the rate of movement of the frame is relatively slow at such time, little braking effect is required. The bi-sinusoidal arrangement inherently provides both a braking action and a static brake.

It is also to be noted that as the rate of movement of the secondary members **71** with respect to the primary members **58** may be varied depending upon the relative diameters of the gears **82** and **88**, the secondary member **71** may be fully extended between the beams **16** of the stall while the beams **58** have only partially extended therebetween. As a result, less heavy structure may extend outwardly from the elevator so that the size and weight of the beams **58** may be held to a minimum.

As the secondary members **71** are individually extended and retracted, they require no connection therebetween and hence the shelves forming the floors of the stalls may be connected at their inner ends in the manner described, eliminating the need for heavy supporting structure which would be required if the extending members of the conveyor were joined, as such connection between the members **71** would require the shelves to be formed only of spaced beams without transverse support at their inner ends for movement of the conveyor members **71** therebetween.

Although the equipment has been illustratively shown and described with respect to its application in parking of automobiles, it is of course to be understood that it could be used to transfer crates, boxes, merchandise and the like and the use of the equipment for this purpose is within the scope of the invention.

It is further to be understood that although a plurality of vertically aligned stalls are shown, the equipment could be used on a single level installation. In such case the elevator could be mounted as to move at right angles to the stalls into transverse alignment therewith.

In addition, an elevator capable of movement at right angles to the stalls could also be used in conjunction with a plurality of vertically aligned stalls so that a single elevator would be sufficient.

As the control mechanism for automatically operating the equipment in timed sequence forms no part of this invention and would be obvious to one skilled in the art, it has not been described.

As many changes could be made in the above equipment, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. An installation for transferring automobiles, comprising a vertical supporting structure, a horizontal platform comprising a plurality of parallel alternating troughs and crests extending outwardly from said support, means extending transversely across said platform supporting the latter near its outer end, a second horizontal platform, means to effect vertical movement of said second platform with respect to said first platform, a conveyor mounted on said second platform, said conveyor comprising a plurality of spaced parallel horizontal members, each of said members including an elongated primary member and an elongated secondary member, both adapted to be longitudinally aligned with one of said troughs, the outer ends of said horizontal members being in juxtaposition with the outer end of an associated trough when longitudinally aligned therewith, means interconnecting said primary members adjacent their central portion to form a rigid assembly, means slidably mounting said assembly on said second platform, means slidably mounting said secondary members on the associated primary member for movement longitudinally with respect thereto to extend outward thereof, means to retain the inner end of each of said secondary members in engagement with the end of the associated primary member when said secondary member has been extended, means to effect movement of said rigid assembly and drive means associated with each of said secondary members and controlled by the movement of said assembly to effect simultaneous individual horizontal movement thereof when said rigid assembly is moved, whereby each of the secondary members and a portion of the associated primary member will be moved into an associated trough.

2. The combination set forth in claim 1, in which said first platform comprises a plurality of spaced parallel beams that define said troughs and crests, and a transverse member is secured to the undersurface of said beams near their outer ends.

3. The combination set forth in claim 1, in which the means interconnecting said primary members comprises a beam, drive means are provided controlled by the movement of said beam to actuate the plurality of drive means associated respectively with said secondary members, said drive means comprising a drive shaft extend-

ing transversely with respect to said horizontal members, means to rotate said drive shaft upon movement of said connected horizontal members, a plurality of gears mounted on said shaft and associated respectively with said secondary members, a rack secured to each of said secondary members and engaged by the associated gear, whereby upon movement of said beam and rotation of said drive shaft, the gears thereon will rotate to drive the associated secondary member.

4. The combination set forth in claim 3, in which the means to rotate said drive shaft comprises a gear mounted thereon and a rack secured to said second platform and engaged by said gear.

5. The combination set forth in claim 1 in which two transversely aligned vertical columns of first platforms are provided, arranged with said first platforms transversely aligned and with the troughs and crests of the respective pairs of transversely aligned platforms longitudinally aligned, the space between said columns defining an elevator shaft, said second platform is an elevator positioned in said shaft and movable vertically into substantially transverse alignment with pairs of transversely aligned platforms, said conveyor being movable from a central position on said second platform toward and away from either of the platforms of said pair.

6. The combination set forth in claim 1, in which a pair of spaced transversely aligned first platforms are provided having the troughs and crests of the respective platforms longitudinally aligned, said second platform is positioned in the space between said stalls, the means interconnecting said primary members comprises a beam extending centrally across said horizontal members, a pair of beams are affixed at their mid points, respectively, to the ends of said conveyor beam and extending at right angles thereto and means secured to said second platform slidably mounting said pair of beams for movement on said second platform in direction parallel to the length of the troughs from a central position on said second platform toward and away from either of the platforms of said pair.

7. The combination set forth in claim 6, in which the means on said second platform slidably mounting said pair of beams and the means slidably mounting the secondary members with respect to an associated primary member, each comprises a set of at least three rollers associated with each of said beams and with each secondary member, one of the rollers of each set, when the connected members are in central position, supporting the associated beam and the secondary member at its central portion, and the other two rollers of each set supporting the ends of the associated beam and the secondary member, the drive means comprises a drive shaft extending along said conveyor beam, a drive gear affixed to said shaft, a rack secured to said second platform and engaged by said gear, said rack extending parallel to said pair of beams, a plurality of gears mounted on said shaft and associated respectively with said secondary members, a rack secured to each of said secondary members and engaged by the associated gear of said plurality, whereby upon movement of said connected primary members and rotation of said drive shaft, the plurality of gears thereon will rotate to drive the associated secondary member.

8. The combination set forth in claim 6, in which the means on said second platform slidably mounting said pair of beams and the means slidably mounting the secondary members with respect to an associated primary member, each comprises a set of at least four rollers associated with each of said beams and with each secondary member, two of the rollers of each set, when the connected members are in central position, supporting the associated beam and the secondary member on each side of its central portion, and the other two rollers of each set supporting the ends of the associated beam and the secondary member, the drive means comprises a pair of parallel drive shafts extending along said conveyor beam, a drive gear affixed to each of said shafts, an idler gear between said drive gears and engaging the latter, a rack secured to said second platform and engaged by said drive gears, said idler gear being spaced from said rack, said rack extending parallel to said pair of beams, a plurality of gears mounted on each of said shafts and associated respectively with said secondary members, a rack secured to each of said secondary members and engaged by the associated gear of said plurality, whereby upon movement of said connected primary members and rotation of said drive shafts, the plurality of gears thereon will rotate to drive the associated secondary member.

9. The combination set forth in claim 1, in which the means interconnecting said primary members comprises a beam, extends transversely across said primary members, means slidably mounting the beam on said platform for movement in the same direction as said secondary members, a pair of spaced parallel tracks mounted on said platform and extending at right angles to said beam and positioned beneath the latter, a frame slidably mounted on said tracks, said frame having a pair of spaced parallel members extending at right angles to said tracks, a vertical drive shaft centrally located on said platform between said tracks, a crank bar mounted on said shaft at right angles thereto, a pair of drive pins associated respectively with said pair of parallel members and adapted to react thereagainst upon rotation of said crank bar to effect movement of said frame, means controlled by the movement of said frame to effect movement of said beam on its slidable mount, and means actuated by movement of said beam to actuate said drive means.

10. The combination set forth in claim 9, in which the means to effect movement of said beam comprises a lever pivoted between its ends on a vertical axis secured to said frame, a pair of track sections, one being secured to said platform and the other to said beam, and means on the ends of said lever riding along the respective track sections and reacting thereagainst.

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