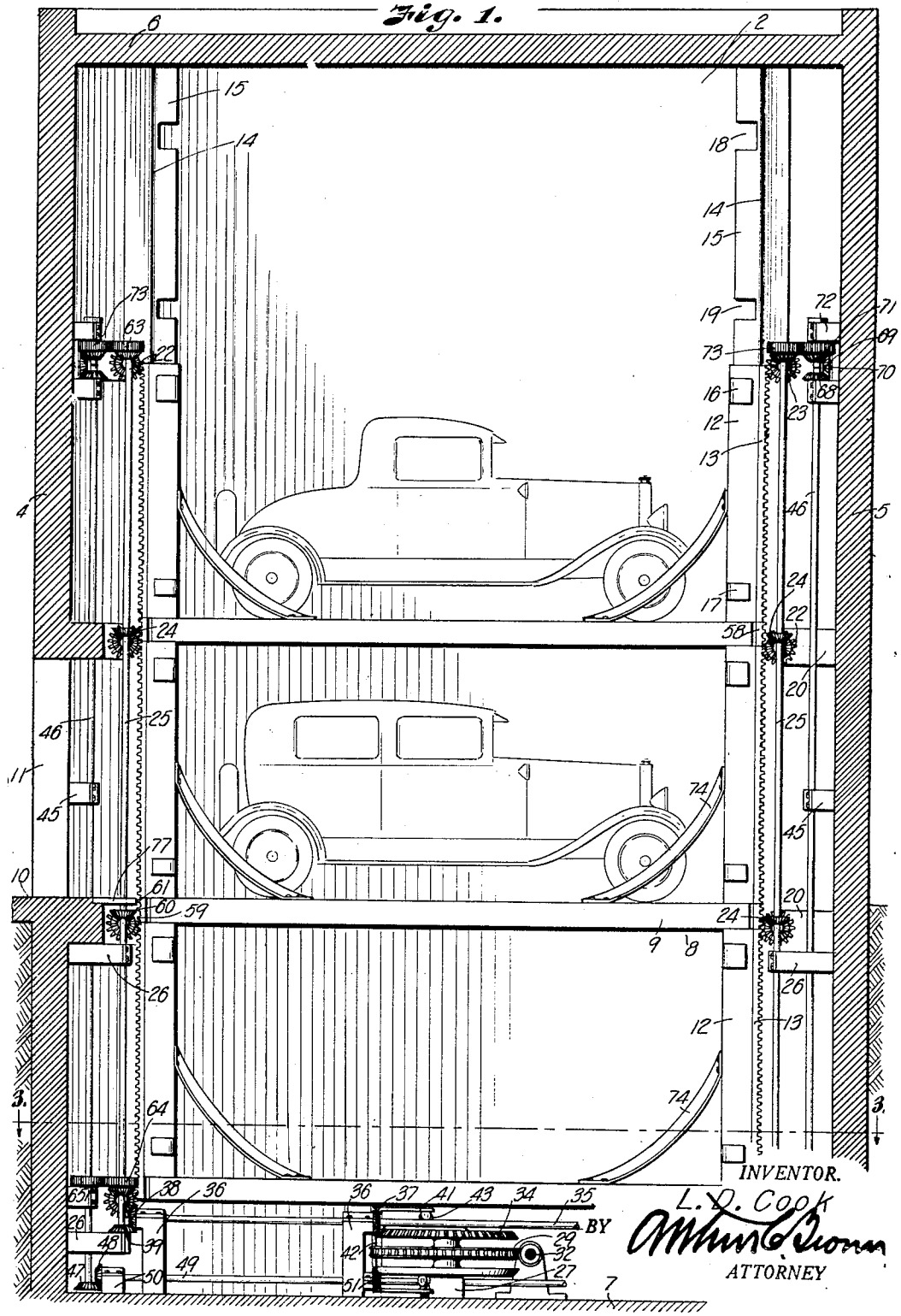
Aug. 4, 1931. L. D. COOK 1,817,237

STORAGE GARAGE

Filed Oct. 20, 1928 4 Sheets-Sheet 1

Fig. 1.

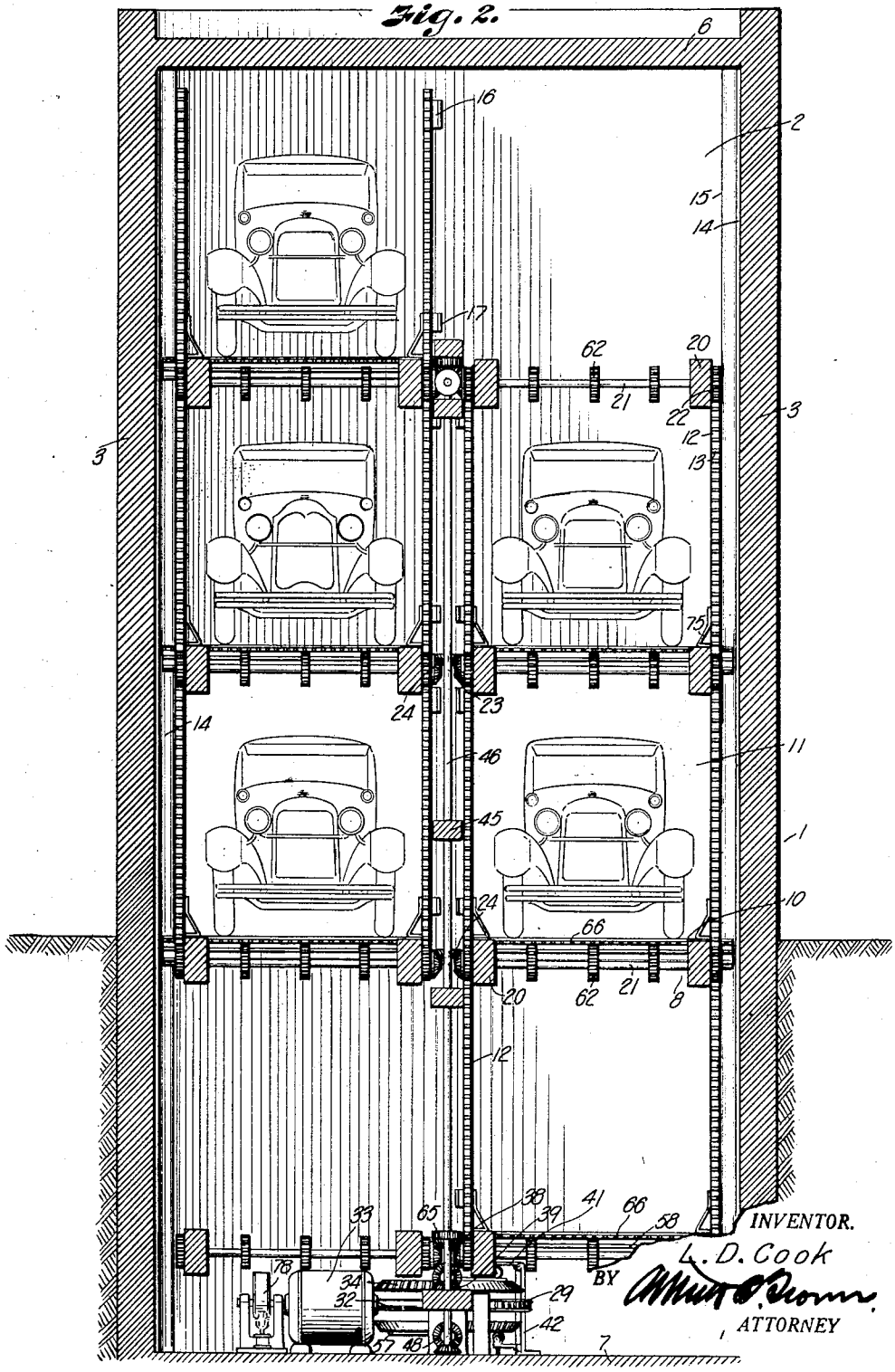


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STORAGE GARAGE

Filed Oct. 20, 1928 4 Sheets-Sheet 2

Fig. 2.



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Filed Oct. 20, 1928 4 Sheets-Sheet 3

Fig. 3.

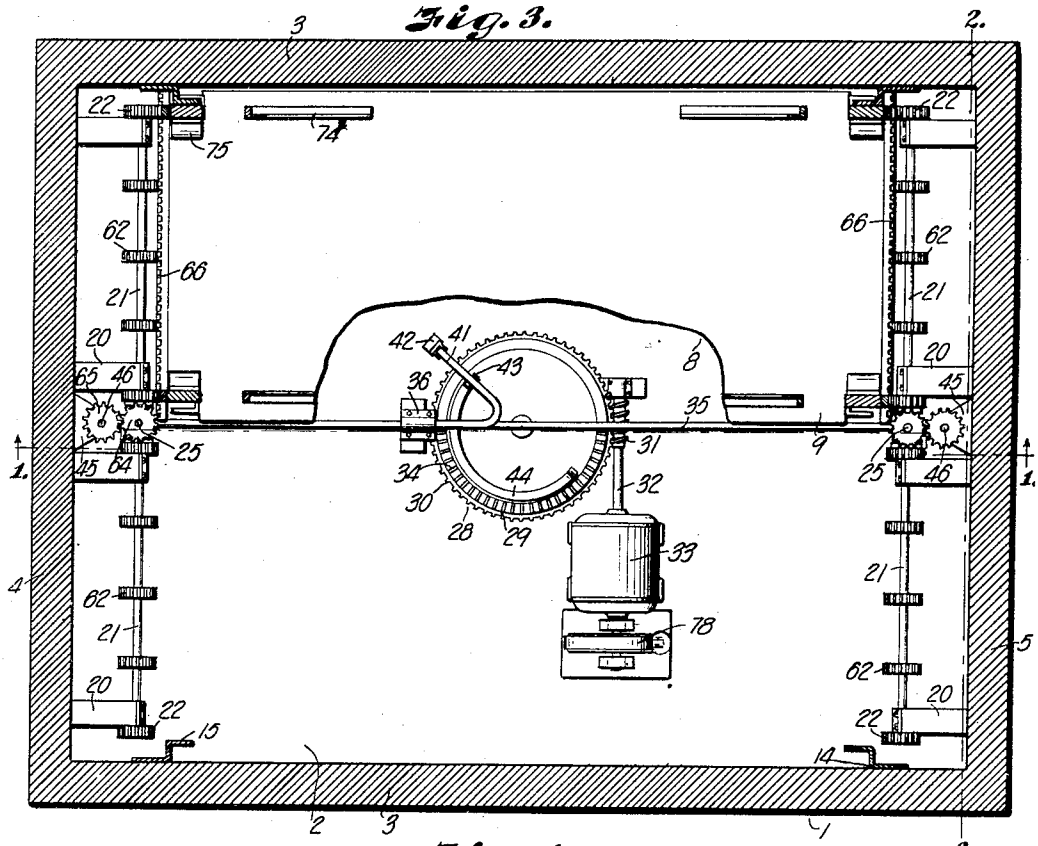
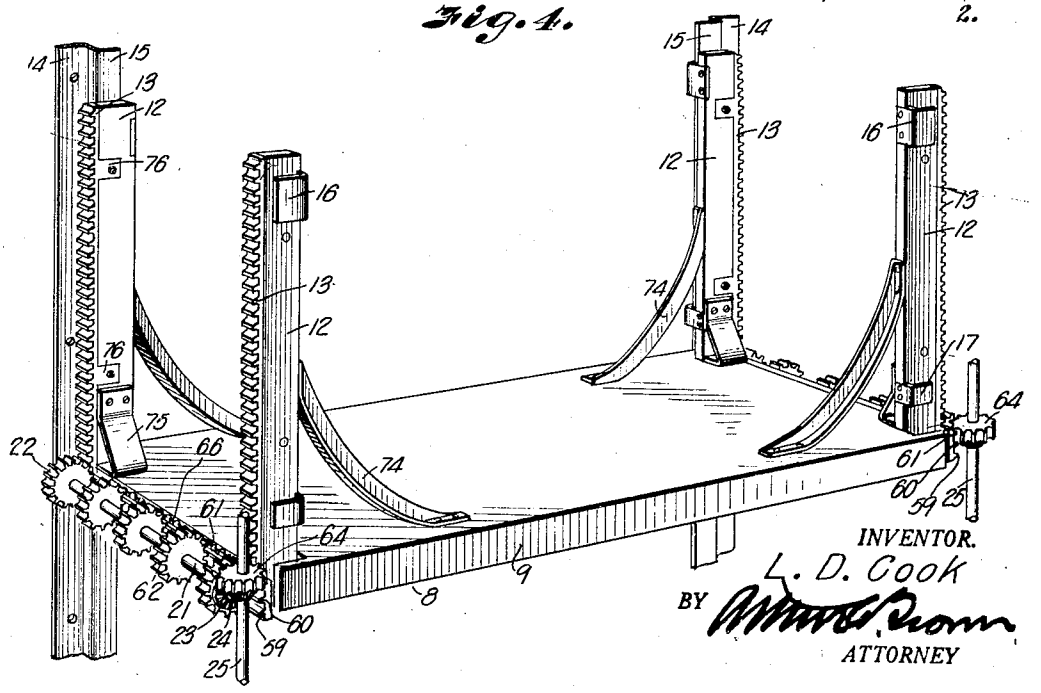


Fig. 4.



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STORAGE GARAGE

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Fig. 5.

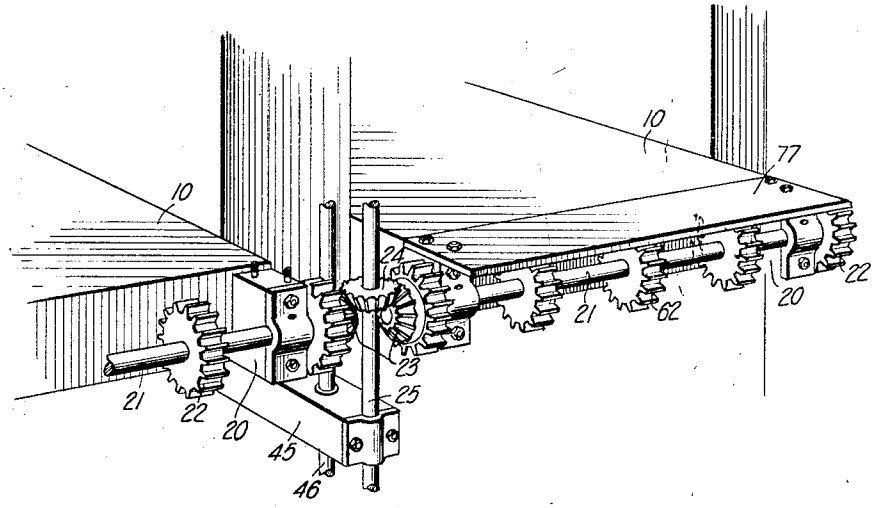
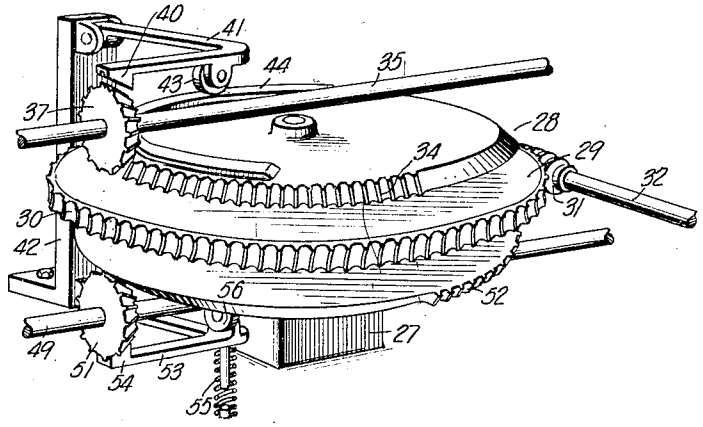


Fig. 6.



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1,817,237

UNITED STATES PATENT OFFICE

L. D. COOK, OF KANSAS CITY, MISSOURI

STORAGE GARAGE

Application filed October 20, 1928. Serial No. 313,765.

My invention relates to storage garages and more particularly to elevators for moving vehicles to different levels, the principal objects of the invention being to expedite the transfer of vehicles to and from storage areas, to adapt elevator mechanism for moving a plurality of vehicles simultaneously and particularly to adapt elevator mechanism for both transferring and storing vehicles.

Further objects of the invention are to provide a series of cages movable in adjacent tracks upwardly and downwardly to adapt the apparatus for automatically shifting the cages from one track to the other whereby the cages may be moved upwardly in one track, shifted to the other track and moved downwardly therein, to cause the cages to register automatically with a loading floor, to coordinate elevating and shifting mechanism whereby one will be idle when the other is operable, and to drive the entire mechanism from a single transmission unit.

In accomplishing these and other objects of the invention, I have provided improved details of structure the preferred forms of which are illustrated in the accompanying drawings; wherein:

Fig. 1 is a central vertical section through a storage garage constructed in accordance with my invention, the view being on the line 1—1 Fig. 3 and illustrating particularly the manner of elevating and lowering vehicle-supporting cages.

Fig. 2 is a vertical section on the line 2—2, Fig. 3 illustrating particularly the means for shifting or conveying cages from one tier to another.

Fig. 3 is a cross section on the line 3—3, Fig. 1, illustrating the driving circuit and its operative relation with the driven mechanism.

Fig. 4 is a detailed perspective view of one of the cages and portions of guide bars for the cages.

Fig. 5 is a fragmentary perspective view of the entrance and exit runway illustrating its relation to a series of elevator gears and their mountings.

Fig. 6 is a detailed perspective view of the transmission, showing fragmentarily the connections with the driving unit and the driven mechanism.

Referring in detail to the drawings:

1 designates generally a building provided with any desired number of storage compartments such as 2 consisting of side walls 3 and front and rear walls 4 and 5, a roof 6, and a floor 7 here shown as located below the ground level.

The compartment comprises an integral structure adapted to support and receive my storage apparatus including a plurality of vehicle supporting racks or cages 8 arranged longitudinally in two slightly spaced tiers, the apparatus being adapted for moving the cages upwardly in one half of the compartment while moving the cages of the other tier downwardly; and shifting the top cage of one tier and the bottom cage of the other tier laterally into the adjacent portion of the compartment, all of which will be particularly described.

The cages comprise floors 9 adapted to register with a runway 10 on the ground level at the lower edge of a door opening 11 in the front wall 4, and posts 12 fixed to their outer ends at each corner and provided with racks 13 for engagement by means presently described for supporting and moving the cages vertically, whereby the cages may be brought into registry with the runway for moving vehicles into the apparatus and delivering them therefrom.

The cages are stabilized and guided by guide bars 14 fixed to the side walls and having offset portions 15 forming flanges interlocked with hooks 16 and 17 secured to the posts in vertically spaced relation, the guide bars having notches 18 and 19 at upper and lower ends through which the hooks may pass when a cage is shifted from one portion of the compartment to the other. In each position of the cages, the hooks on the posts at the side adjoining a side wall, engage the bars, the inner side becoming the outer side when the cage is shifted from one portion of the compartment to the other. The notches correspond to the hooks in size, the

lower notches 19 being smaller than the upper notches 18, whereby the larger upper hooks 16 will pass the smaller lower notches 19 without tending to enter the same when the cages pass over the notched portions of the guide bars.

It should be mentioned for clarity at this point that the cages are so arranged that when the upper edge of a tier in one portion of the compartment is positioned for being shifted, the corresponding upper area in the opposite portion of the compartment will be vacant to receive the shifted cage, a similar condition existing in the lower end of the compartment; and it being understood, as will be later described, that the elevating mechanism ceases operation when the shifting mechanism is operable, and vice versa.

Supported at suitable vertical intervals from the end walls by bearing brackets 20, and at each end of the two tiers of cages (Fig. 4), are transverse rotatable shafts 21 having spur gears 22 fixed thereon adjacent their ends and in mesh with the rack teeth of the cage posts, and bevel gears 23 extending horizintally on their inner ends in mesh with bevel pinions 24 fixed to a pair of vertical rotatable elevator shafts 25 supported and braced by brackets 26 fixed to the opposite end walls of the compartment whereby rotation of the vertical elevator shafts will cause vertical movement of the cages.

The transverse shafts 21 for the two tiers are suitably aligned and spaced so that each of said bevel pinions 24 on the elevator shafts coincidentally engages the end bevel gears 23 on aligned transverse shafts, and rotate said aligned shafts oppositely, whereby the elevator shafts support and move the cages of one tier upwardly while moving the cages of the other tier downwardly.

Supported by a bearing pedestal 27 centrally located on the floor of the compartment is a transmission element 28 comprising preferably a circular body 29 having a continuous series of gear teeth 30 comprising a worm wheel, and a worm gear 31 on a shaft 32 of a motor 33 is in mesh with said worm wheel for rotating the same. Projecting from the body 29 and preferably formed integrally therewith is a gear rack segment 34 formed on an arc concentric with the worm wheel. A horizontal shaft 35 extending longitudinally of the compartment centrally thereof and supported by bearing posts 36 from the floor, is provided with a bevel pinion 37 engageable with said rack segment 34, and bevel pinions 38 on its outer ends in mesh with bevel gears 39 on the lower ends of the elevator shafts, whereby the transmission is adapted to operate the elevator shafts when the rack segment 34 is engaged with the pinion 37 on the longitudinal elevator shaft 35 for moving the cages vertically.

The rack segment is of such length that it will operate through the pinion 37 to move the cages over a distance equal to substantially the height of a cage, and when the cages have been moved to that extent the pinion will become disengaged from the segment. The longitudinal shaft, otherwise free to rotate, and normally substantially balanced by the substantially equal weight of the two tiers of cages, is latched by a tooth 40 on an arm 41 hinged to a bracket 42 mounted on the floor adjacent the transmission and tending to move into engagement with the pinion 37.

A roller 43 pivotally supported by the arm 41 runs on a cam track 44 formed on the body 29, the cam tapering downwardly toward the outer end of the rack segment 34 whereby the tooth will move into engagement with the pinion when the rack segment moves away from pinion engaging position.

The elevator operating gear segment is illustrated as positioned on the upper face of the transmission body and the arm 41 is shown as influenced by gravity to move into engagement with the pinion.

When the rotating transmission brings the gear segment around to the position of the pinion, the roller will rise over the cam and lift the arm to release the tooth from the pinion substantially at the instant when the segment engages the pinion. The vertical movement of the cages is thus interrupted periodically, and at the stage of movement when two of the cages are in registry with the runway. The motor may be stopped at such a stage.

The shifting mechanism above referred to whereby the cages are automatically moved horizontally and laterally from one portion of the compartment to the other, at the top and at the bottom thereof, will now be described in detail.

Rotatably supported in bearing brackets 45 fixed to the end walls are vertical shift shafts 46 having bevel gears 47 at their lower ends in mesh with bevel pinions 48 on the outer ends of a horizontal shaft 49 extending from front to back of the compartment centrally thereof and supported from the floor by brackets 50. A pinion 51 fixed to the shaft 49 is adapted to engage a rack segment 52 fixed to the transmission body 29 oppositely to the elevator rack segment 34. In this instance the segment 52 is on the lower face of said body, and disposed oppositely to said elevator-operating segment for operatively engaging the bevel gear 51 when the elevator operating segment is out of engagement with the elevator operating pinion 37 and shaft 35.

An arm 53 hinged to the bracket 42 has

a tooth 54 adapted to engage the pinion 51, the arm being urged by a spring 55 to move the tooth toward the pinion. A roller 56 pivotally mounted on the arm runs on a cam 57 for lifting the tooth from the pinion and permitting it to engage the pinion when the transmission moves the elevator operating segment away from the pinion 37 on the elevator operating shaft 35.

Mounted on the ends of the cage floors are plates 58 having longitudinal ribs or teeth 59, 60 and 61 corresponding to the teeth of the post racks 13. Spaced spur gears 62 are fixed on the shafts engageable with said ribs so that when the shafts 21 are rotating and the cages moving vertically, the gears will rotate over the ribs in mesh therewith, and when the cages are stopped in positions wherein the gears are engaged with the ribs, the shafts 21 and gears 62 will support the cages.

Since there are aligned shafts at the several positions as described and since the cages are held in permanent relation through engagement of the cage racks with the end spur gears on the shafts 21, the aligned gears on the aligned shafts provide supports for the cages when the ribs on the end plates are engaged with the gears, and the cages may therefore be moved laterally by sliding the ribs over the supporting teeth of the gears 62 from one set of gears to the set in the adjoining compartment.

The cages are automatically shifted through idling gears 63 mounted on the upper ends of the elevator operating shafts, and similar gears 64 loosely mounted on the lower ends of said shafts, and constantly meshed with pinions 65 fixed on the shift shafts, the idling gears 63 and 64 being normally meshed with teeth 66 on the upper ribs 61 of the cage floor end plates, whereby when the shift shafts are rotated the idling gears are rotated to move the cages laterally on the supporting teeth of the gears 62.

The upper assemblies for transmitting motion of the vertical shift shafts to the idling gears and racks on the ends of the cage floors preferably include bevel gears 68 fixed to said shift shafts, bevel gears 69 rotatable on pins 70 supported by the walls and engaged with bevel gears 71 supported by brackets 72 above the ends of the shafts, and spur gears 73 fixed to the last named bevel gears and pins for meshing with the idling spur gears on the elevator shafts.

The cages may be reinforced in any suitable manner, for example and preferably by providing longitudinally extending arcuate brace members 74 fixed to the floors and posts, and bracket-like braces 75 mounted on the sides of the posts and fixed to the floor. The rack bars are preferably attached to the outer faces of the posts, for example, by ears 76 bolted to the posts.

Plates 77 may be attached to the front wall to guard the shafts and gears at that point.

Apparatus illustrated includes a compartment large enough to contain 2 tiers of 4 cages each, and three cages are initially provided in each tier.

Means may be provided for further controlling and regulating the motor and movements of the cages, such as a speed control device 78 comprising a magnetic brake adapted to retard the speed of the motor as the cages approach the end of a stage of their travel, to avoid abrupt stoppage of the cages while moving at normal speed, and the control device may be of a type used in common practice for such a purpose in elevator apparatus.

In operating the device for receiving a vehicle for storage, the motor is controlled to stop the cages so that an empty cage in either tier is at the opening, and the vehicle is driven onto the cage floor. Rotation of the transmission element clockwise in the figures causes the elevator shaft operating pinion to engage the rack segment on the upper face of the transmission, and the elevating shafts operate to move the cages upwardly in the right hand portion of the compartment and downwardly in the other portion.

When the upper rack segment passes away from the elevator operating pinion the latch member engages said pinion to latch the elevator operating train of shafts and gears, and coincidently the constantly moving transmission moves the shift rack segment into engagement with the shift pinion.

The shift shafts then operate to rotate the idling pinions and cause them to move the upper cage in the right hand tier to the left hand portion of the compartment and coincidently move the lower cage in the left hand tier into the right hand compartment.

The limited extent of the shift rack segment on the transmission is adjusted to the ratios of teeth on the several elements of the gear train so that the shifting mechanism is disconnected, and the lower latch member moves into engagement with the shift pinion, when the said moved cages reach their new positions in the tiers.

The elevating shafts are then again put into operation by release of the upper latch and engagement of the elevator pinion with the upper gear segment, and the above mentioned series of steps is repeated.

The transmission and motor will be controlled to suspend operation of the apparatus when a vacant cage is positioned at the opening to receive a vehicle for storage or when a cage having a vehicle to be delivered is positioned at the opening.

It is apparent therefore that my device provides for storing a number of cars in relatively small area and in tiers, without necessity for moving the cars from the elevator.

What I claim and desire to secure by Letters Patent is:

1. In garage apparatus of the character described, a plurality of vehicle supporting cages having vertical and horizontal racks, a support, means engageable with the vertical racks for moving the cages vertically of the support, and means including a gear engageable with the horizontal racks for moving the cages laterally of the support.

2. In garage apparatus of the character described, a plurality of vehicle supporting cages, a support, and automatically alternating means including gear trains and a transmission member having rack segments respectively engageable with said trains for moving the cages vertically and laterally of the support.

3. In garage apparatus of the character described, a compartment including end walls, one wall having an opening, a runway at the opening for vehicles adapted to be admitted to the compartment, a plurality of cages arranged in tiers in the compartment, means for supporting and moving the cages including transverse shafts supported from the walls, gears fixed on the shafts engaged with the cages, and vertical shafts having pinions engaged with said transverse shafts, means engageable with the cages for shifting the cages from one portion of the compartment to the other, and means for alternately actuating said vertical shafts and shifting means to move the cages vertically and shift the same.

4. In garage apparatus of the character described, a compartment including end walls, one having a door opening, a runway at the opening, a plurality of cages arranged in tiers in the compartment, means supporting the cages including transverse shafts supported from the walls, means for engaging the shafts with the cages, gears at the ends of the shafts, and vertical shafts having pinions engaged with said gears, said vertical shafts being operable to move the cages vertically, and means including a vertical shifting shaft and a gear train for connecting the shifting shaft with the cages for shifting the cages from one portion of the compartment to the other.

5. In garage apparatus of the character described, a compartment comprising side and end walls, one wall having a door opening and a runway at the opening, a plurality of vehicle supporting cages arranged in adjacent tiers in the compartment, means including a gear supported by one of the walls for supporting the cages and including means for moving the cages vertically, means for shifting a cage from one tier to the other, means including said gear for supporting the cages while being shifted, and operating means alternately operating said vertically moving and said shifting means.

6. In garage apparatus of the character described, a compartment comprising side and end walls, one wall having a door opening, a runway at the opening, a plurality of vehicle supporting cages arranged in adjacent tiers in the compartment, means for moving the cages vertically including means for supporting the cages, means for shifting a cage from one tier to the other, means for supporting the cages while being shifted, operating means alternately effective on said vertically moving and said shifting means, and automatically effective means for alternately latching said moving and said shifting means when inoperative.

7. In garage apparatus of the character described including a support, a plurality of vehicle supporting cages arranged in adjacent tiers, means for supporting and moving the cages vertically, means for shifting a cage from one tier to the other, and operating means alternately effective on said vertically moving and said shifting means, and including a transmission member having a plurality of rack segments, and gear trains respectively engageable with said segments.

8. In garage apparatus of the character described, in combination with vertical fixed supports and a plurality of vehicle-receiving cages, a plurality of transverse shafts rotatably mounted on the supports, each shaft having an elevator spur gear at one end and selected shafts having intermediate fixed spur gears for supporting a cage during shifting thereof, a vehicle-receiving cage comprising a floor having longitudinal ribs at one end for engagement with said intermediate gears and vertical rack posts for engagement by said elevator spur gears, and operating means including a vertical elevator shaft constantly engaged with said transverse shafts, a vertical shift shaft, means for engaging the shift shaft with said cages to move the same laterally, and common means alternately effective for actuating said elevator and shift shafts.

9. In garage apparatus of the character described, a cage having a transverse rack bar, means for supporting the cage in position for vertical movement, including means for moving the cage vertically including a shaft releasably geared to the cage, means for moving the cage laterally including an idler pinion loosely mounted on said shaft and engageable with said rack bar, and a shaft geared to said pinion, alternately effective means for operating said shafts, and

means for supporting the cage in shifting position.

10. In garage apparatus of the character described comprising a fixed support, a cage, a shaft for moving the cage vertically, and a shaft for moving the cage laterally, operating means including a worm wheel having rack segments on opposite faces, gears on said shafts intermittently engageable with said segments for rotation of said shafts from the wheel, cams adjacent said rack segments, and latch members tending to move into engagement with said gears and controlled by said cams for engaging the gears when the same move out of engagement with said segments.

11. In a storage garage, a compartment including end walls, a plurality of cages arranged in tiers in the compartment, horizontal shafts supported from the walls, vertical shafts provided with pinions, a plurality of sets of gears on said transverse shafts engaged respectively with said cages and with said vertical shafts, means engageable with the cages for shifting the same from one portion of the compartment to another portion of the compartment, and means for actuating said vertical shafts and shifting means to respectively move the cages vertically and shift the same.

12. In a device of the character described, a cage, a support, and means including gear trains and a transmission member having rack portions respectively engageable with said trains for moving the cage respectively vertically and laterally of the support.

13. In a device of the character described, in combination with a support, and a cage movable vertically and laterally on the support, means including gear trains and a transmission member having racks engageable respectively with said gear trains operating automatically to move the cage alternately vertically and laterally on the support.

In testimony whereof I affix my signature.

L. D. COOK.