Jan. 21, 1936. H. HARNISCHFEGER 2,028,391

GARAGE

Filed Dec. 31, 1927 5 Sheets-Sheet 1

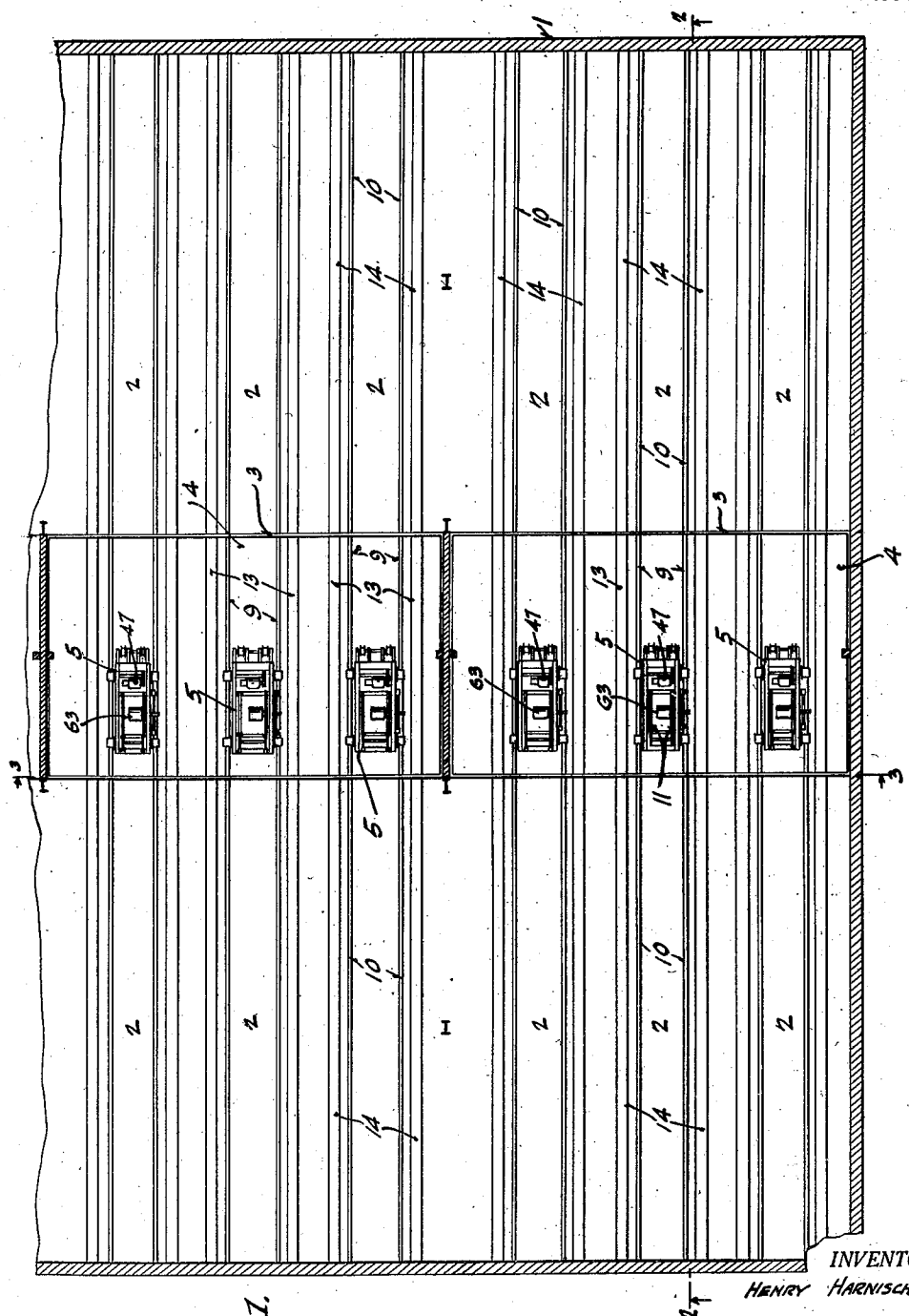


Fig. 1.

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GARAGE

Filed Dec. 31, 1927 5 Sheets-Sheet 2

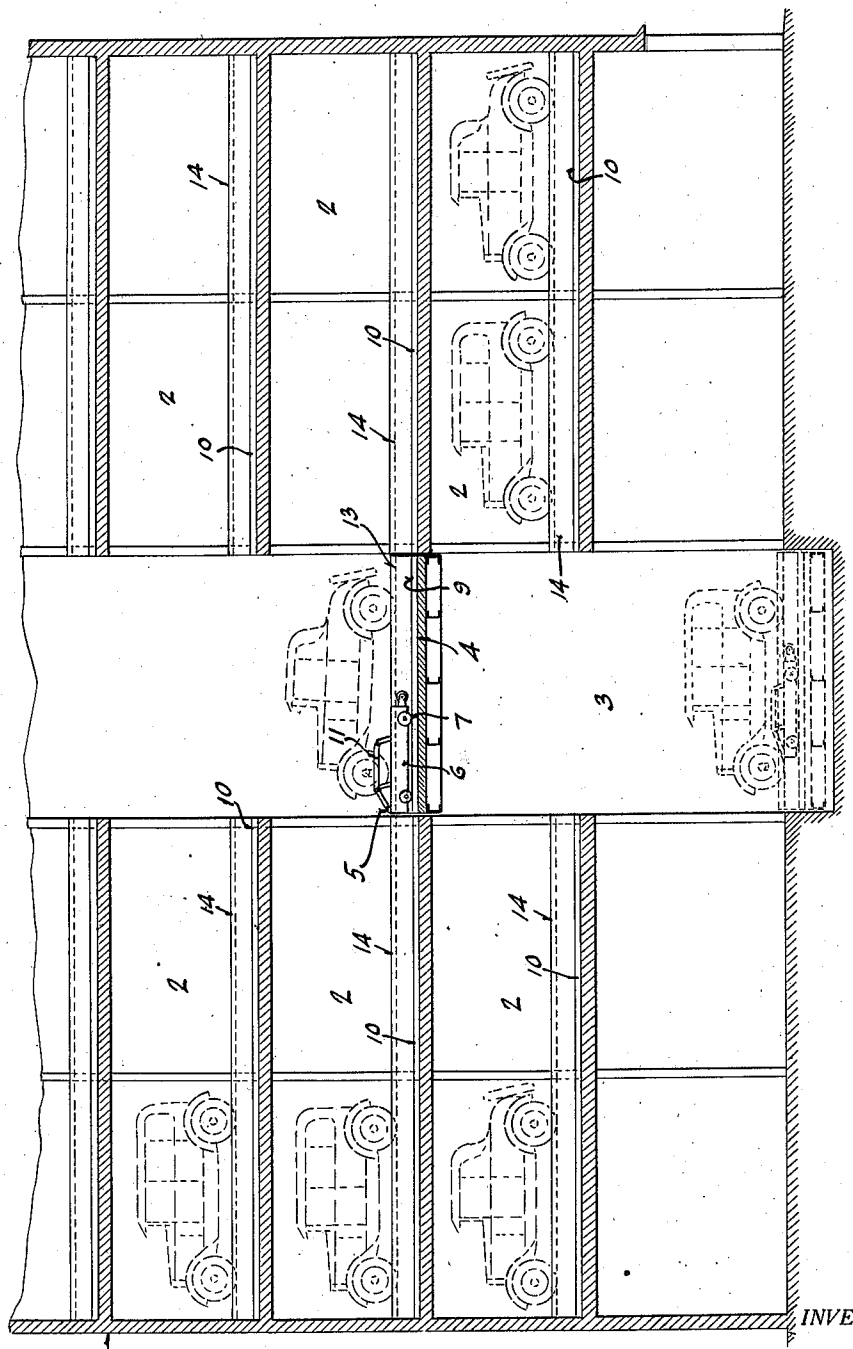


Fig. 2.

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Jan. 21, 1936. H. HARNISCHFEGER 2,028,391

GARAGE

Filed Dec. 31, 1927 5 Sheets-Sheet 3

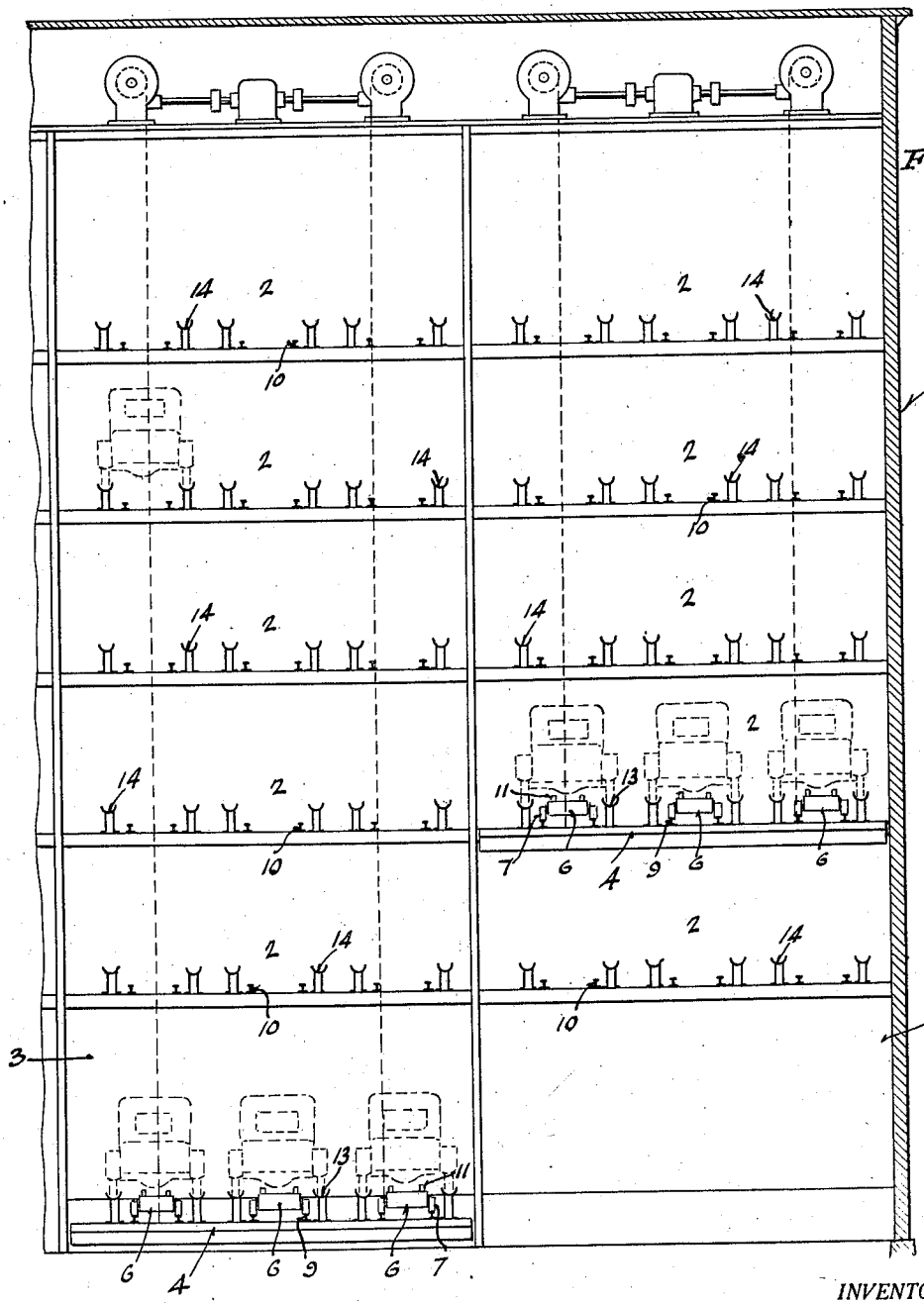


Fig. 3.

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Jan. 21, 1936. H. HARNISCHFEGER 2,028,391

GARAGE

Filed Dec. 31, 1927 5 Sheets-Sheet 4

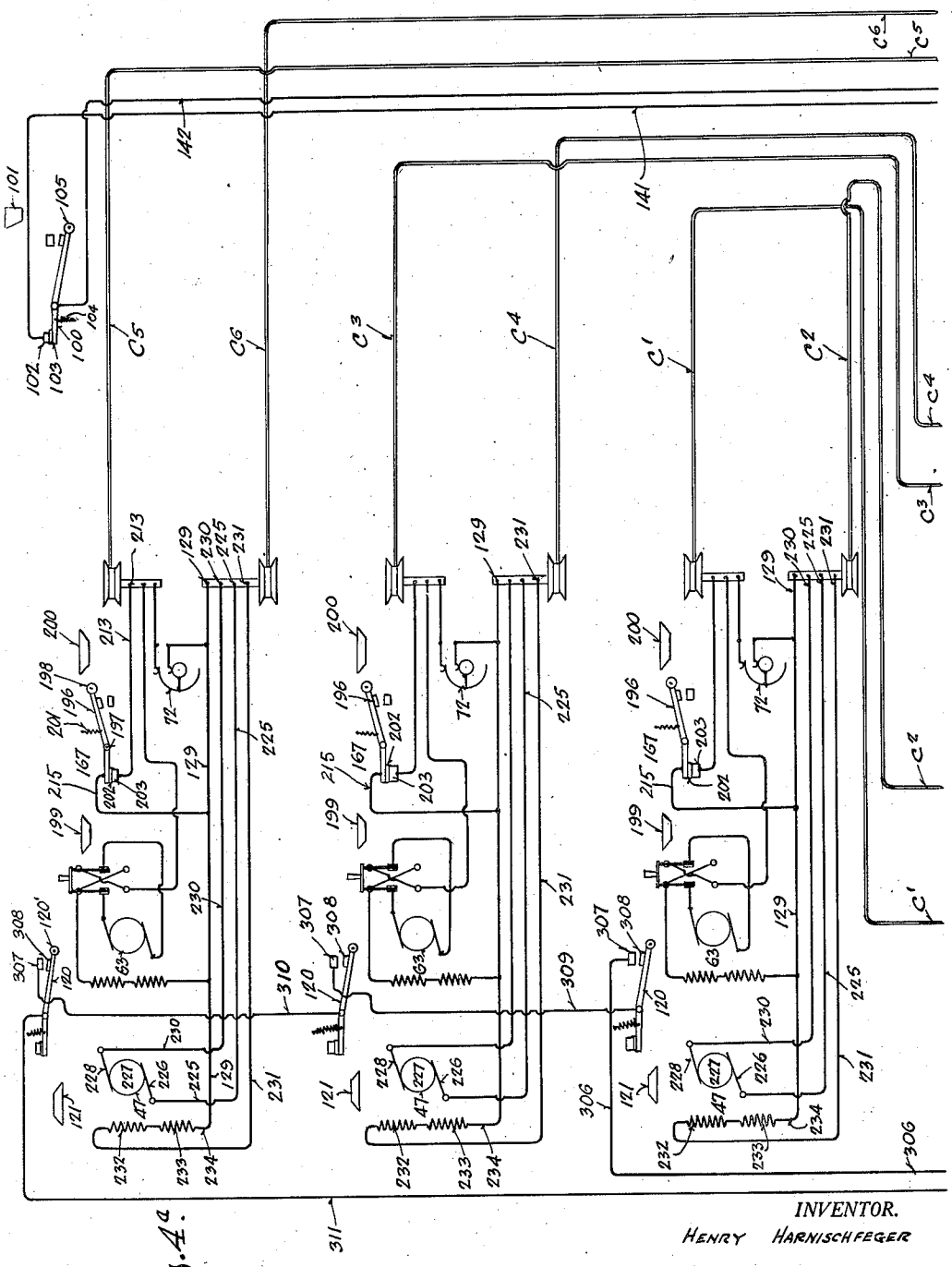


Fig. 4.

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Jan. 21, 1936. H. HARNISCHFEGER 2,028,391

GARAGE

Filed Dec. 31, 1927 5 Sheets-Sheet 5

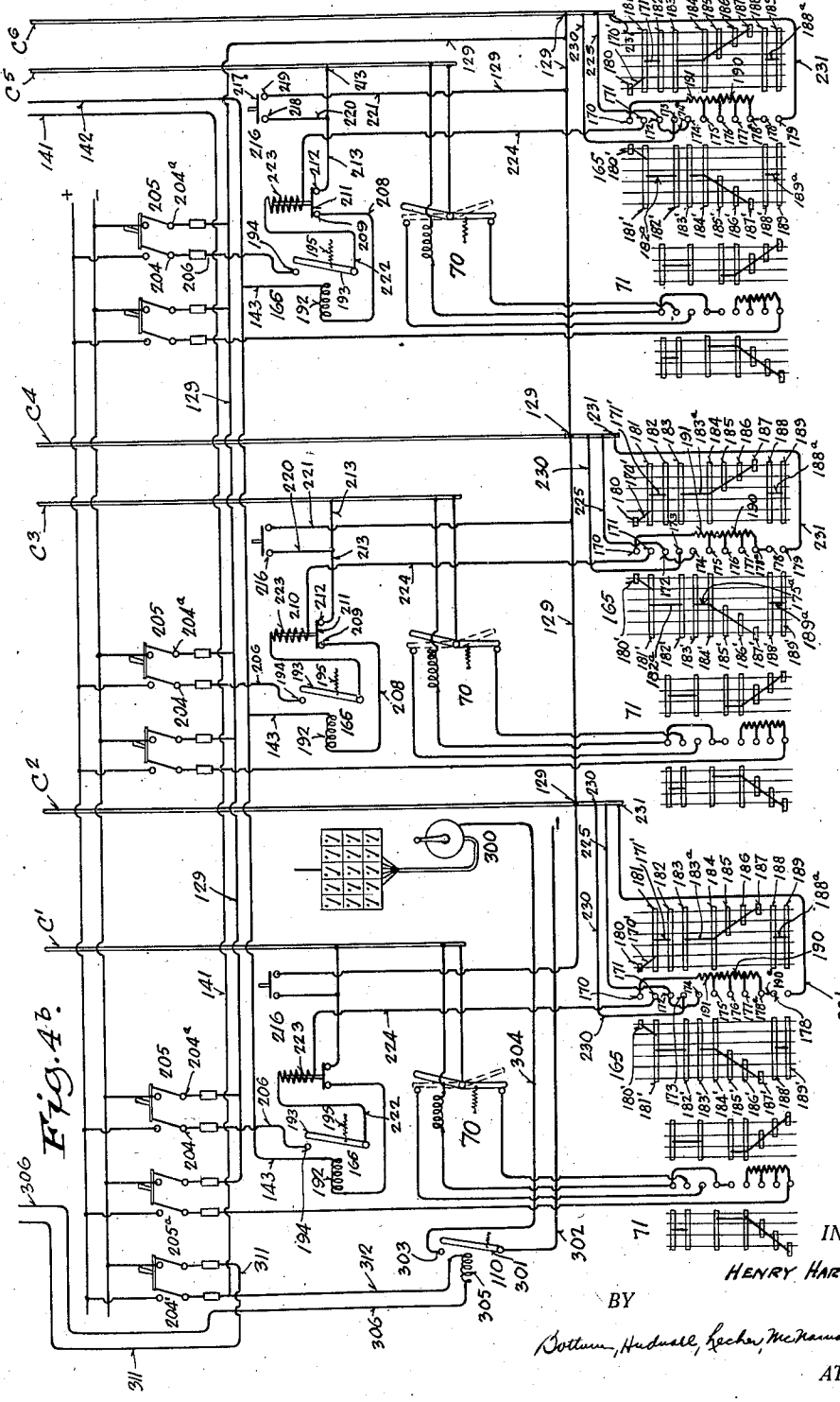


Fig. 4b.

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Patented Jan. 21, 1936 2,028,391

UNITED STATES PATENT OFFICE

2,028,391

GARAGE

Henry Harnischfeger, Milwaukee, Wis., assignor to Harnischfeger Corporation, Milwaukee, Wis., a corporation of Wisconsin

Application December 31, 1927, Serial No. 243,812

6 Claims. (Cl. 214—16.1)

This invention relates to an apparatus for storing and handling vehicles such as automobiles or the like, and is especially designed for embodiment in a building devoted to the storage of motor vehicles.

One object of the present invention is to provide an apparatus of this character which is especially designed and adapted for use in buildings of relatively great height and which in such buildings effects the expeditious handling of the vehicles with a minimum of mechanical equipment thereby reducing the original cost of the apparatus and also reducing the cost of maintaining and operating the same.

Another object of the present invention is to provide an apparatus of this character which mechanically handles and stores the vehicles with promptness and despatch, without possibility of confusion or liability of damage to the vehicle or to the apparatus and in such manner as to economically and completely utilize the floor space of the building to best advantage.

In carrying out the present invention, a garage building is provided having a plurality of floors with storage compartments on the several floors, the storage compartments being vertically alined and located on the opposite sides of an elevator well in the building, the arrangement consisting essentially of tiers of storage compartments flanking an elevator well. A plurality or a row of tiers are arranged on each side of the elevator well, the elevator well being elongated and extending substantially for the full length of the building or at least for the full length of the rows of tiers of storage compartments. A number of elevators are provided in the well and each elevator has a plurality, usually three, transfer carriages or dollies or other suitable transferring devices thereon. The elevators and also the storage compartments may have run-ways for receiving the wheels of the vehicles handled. Each storage compartment may be designed to receive one, two, or more vehicles in end to end relation. The transfer carriage shown is motor driven and runs on rails on the elevator and on rails in the storage compartments. Each transfer carriage has a jack or hoist associated therewith which may be raised to engage under one end of an automobile, usually under the front axle, to raise such end of the automobile and to propel it on its other end. With this construction the automobiles are run into a receiving station on the ground floor of the building, the transfer carriage moves out under the automobile and has its jack engaged with the same and then the transfer carriage runs back onto the elevator and carries the automobile with it. Three automobiles may be loaded on each elevator in this manner. The elevator then rises to the floor or level of the storage compartments into which the automobiles are to be placed and the transfer carriages are then run off of the elevator and into the storage compartments, the jacks of the transfer carriage are then lowered to deposit the automobiles in the storage compartments whereupon the transfer carriages are run back onto the elevator. In delivering any automobile the operation is reversed, that is, the transfer carriages are run off of the elevator, and into the storage compartments under the automobile to be delivered, have their jacks engaged with the automobiles and then are run back onto the elevator pulling or propelling the automobiles with them. At the ground level the transfer carriages carry the automobiles off of the elevator, have their jacks lowered and are then run back onto the elevator.

The transfer carriages are motor driven and novel controls are provided therefor which prevent the transfer carriages from being moved off of the elevator unless the elevator is alined with a floor or level of storage compartments. For this purpose a contactor is incorporated in the circuit for the motor driving each carriage and in series with the coils of all of the contactors is a switch mounted on the elevator, biased to open position and closed by cams at the floor levels in the elevator well. In others words, the switch is closed and the contactor coils may be engaged only when the elevator is alined with a floor or storage compartment.

Limit switches are incorporated in the motor circuits of the transfer carriages for automatically shutting off the motors driving the carriages when the transfer carriage is returned to proper position on the elevated platform. Push button switches are provided for short circuiting the limit switches when the carriages are to be run off of the platform.

Another safety feature is incorporated in the controls which consists in preventing movement of the elevator unless the transfer carriages are properly centered thereon. This is accomplished by incorporating a contactor in the elevator control circuit and placing in series with the coil of the contactor limit switches biased to open position and closed only when the transfer carriages are in proper position on the elevated platform.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be herein-

after more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming a part of this specification, and in which:

Figure 1 is a fragmentary plan view showing a portion of the garage building embodying the present invention;

Figure 2 is a fragmentary view thereof taken in transverse section on line 2—2 of Figure 1;

Figure 3 is a similar view in longitudinal section taken on line 3—3 of Figure 1;

Figure 4a is a portion of a diagram of the circuits involved in the control of the three transfer carriages of each elevator; and

Figure 4b is the other portion of the diagram.

Referring to the drawings, the numeral 1 designates a garage building of any suitable construction and having any suitable number of floors or levels. Each floor of the building has rows of storage compartments 2 on the opposite sides of an elongated elevator well 3. The storage compartments of one floor are alined vertically with the storage compartments of the floors above and below so that the arrangement presents horizontal rows of vertical tiers of storage compartments flanking the elongated elevator well. In other words, a plurality of tiers of storage compartments are provided on each side of the elevator well and are arranged parallel thereto. A plurality of elevators designated generally at 4 are arranged in the elevator well and travel from the ground level to the highest floor or story of the building, so that any elevator may be alined with the storage compartments opposite the same on any floor or level.

On each elevator a number, usually three, transfer carriages or dollies or other transferring devices, designated generally at 5, are provided. As shown, each transfer carriage 5 includes a suitable frame 6 mounted on wheels 7, at least certain of the wheels 7 being driven by suitable gearing from an electric motor 47. The wheels 7 of each transfer carriage run on rails 9, provided on the elevator, and also on rails 10, provided in the storage compartments. A jack or hoist designated at 11 is provided on each transfer carriage and is raised and lowered under the control of an electric motor 63. When the jack 11 is lowered the carriage may be run under an automobile to position the jack under the front axle thereof and then when the jack is raised it engages under the front axle and lifts the front end of the automobile. The rear wheels of the automobile run on the run-ways or tracks 13 provided on the elevator and in similar run-ways 14 provided in the storage compartments. Of course, in lieu of engaging the jack with the front axle it may be engaged with the rear axle or with any other appropriate part of the automobile. But in any event, the jack serves to lift one end of the automobile and to enable the carriage to propel the automobile on the wheels at its other end.

The transfer carriage 5, its jack 11 and the control for the electric motor 63 of the jack are identical with the transfer carriage and jack shown and fully described and claimed in the co-pending application of Arthur G. Henricks for Apparatus for handling and storing, filed August 22, 1927, Serial No. 214,617, to which reference is made for a detail disclosure of the construction, operation and control of the transfer carriage and jack.

The armature of each electric motor 63, under normal conditions, turns in the same direction to effect alternate raising and lowering of the jack 11. This motion of the armature of the motor 63 is initiated under the manual control of the operator, but the armature shaft is stopped automatically at the end of a raising or lowering movement. In order to provide for this operation of the jack the motor circuit of the electric motor 63 of each transfer carriage has a contactor designated generally at 70, a controller designated generally at 71, and a limit switch designated generally at 72 organized therewith, as shown in Figures 4a and 4b. As these parts are identical with an organized and operated in exactly the same manner as the corresponding parts in the co-pending application of Arthur G. Henricks, Serial No. 214,617, they will not be further described here.

The control of the carriage motors 47 is also identical with that shown in said co-pending application except that there are as many control systems as there are motors 47 and that the circuits including the coils 192 of the contactors 166 controlling the motor circuits have a common path or portion extending through an elevator alinement controlled switch 100 connected in series relation with the coils 192 of the contactors as hereinafter more fully described. The switch 100 is mounted on the elevator and biased to open position to prevent any contactor coil 192 from being energized at any time except when the elevator is leveled with the floor, at which time one of a number of cams 101 in the elevator well closes the switch 100. Moreover, the control circuits for the carriage motors 47 are interlocked with the elevator control circuit so that the elevator may not be moved up or down unless all the transfer carriages on the elevator are properly positioned thereon. This interlock is effected by incorporating a contactor 110 in the elevator control circuit and placing the coil of the contactor in series with carriage controlled limit switches 120. There is one such limit switch 120 for each carriage and the switches are biased to open position but are closed by cams 121, on the elevator when the carriages are properly positioned on the elevator.

When the elevator is alined with the storage compartments at any floor level the carriage or dolly may be run off of the elevator and into the storage compartment to deposit the car therein.

As in the co-pending application referred to above, the motor circuit for each carriage motor has a controller designated generally at 165, a contactor designated generally at 166, a limit switch designated generally at 167, and means for short-circuiting the limit switches when desirable and consisting of push button switches 216 controlling a shunt path around the limit switches 167. While individual limit switches 167 are provided for each carriage motor 47, there is but one elevator alinement controlled switch 100 which is connected in series with the coils of all three contactors, this switch 100 including a fixed contact 102 and a movable contact 103, the movable contact 103 being biased to open position out of engagement with the contact 102 by means of a spring 104 or other equivalent means but having a roller 105 adapted to engage the cam 101 at each floor level in the elevator well so that the contacts 102 and 103 will be engaged and the switch closed when the elevator is alined with any floor. The contact 102 connects by a wire 141 to the positive side of the power line while the contact 103 connects by a wire 142 and branches 143 with one end of each of the coils 192. In prac-

tice, a simplified fuse arrangement makes it desirable to have the positive pole 204' of a knife switch 205a connected to one end of the wire 141, but of course, this is not essential and this wire 141 might be connected to the positive pole 204 of any of the knife switches 205. The other terminal of each coil 192 is connected by a wire 208 with a contact 209 of an overload relay designated at 210. A bridging contact member 211 is incorporated in this relay and engages the contact 209 and also a contact 212. A wire 213 leads from the contact 212 to the contact 203 of the limit switch 167. The other contact 202 of the limit switch 167 connects by a wire 215 with the common return wire 129.

Each controller 165 (as in the other application referred to) has two "On" positions, one for causing rotation of the armature of the motor 45 in one direction, and the other for causing the reverse rotation of the motor, thereby providing for the movements of the carriage onto and off of the elevator platform. To this end each controller has a set of contacts designated generally at 170, 171, 172, 173, 174, 175, 176, 177, 178, 178a and 179, and two sets of segments cooperable with the contacts, one set of segments being designated generally at 180, 181, 182, 183, 184, 185, 186, 187, 188, and 189, and the other set of segments being designated at 180', 181', 182', 183', 184', 185', 186', 187', 188' and 189'. The controller resistance is designated at 190 and a resistance of the conventional armature shunt at 191.

Each contactor 166 (as in the other application referred to) is of conventional construction and has a contactor coil 192 and an arm 193 influenced by the coil and engageable with a contact 194 when pulled over by the coil against the action of its spring 195. Of course, in lieu of a spring the contactor arm may be biased to open position by the action of gravity.

Each limit switch 167 (as in the other application referred to) comprises a lever 196 fulcrumed as at 197 on the carriage and having a roller 198 at one end of the lever engageable with a cam 199 mounted at a suitable point on the elevator platform. A spring 201 is associated with this lever 196 and tends to cause a contact 202 carried by the lever to engage a contact 203 mounted on the carriage. When the rollers 198 engage their cooperable cams 199, the levers 196 are rocked to disengage the contacts 202 and 203.

Each positive pole 204 of the three knife switches 205 connecting with the power lines or source of current has a wire 206 connected therewith and leading to the contact 194 of the contactor. The arm 193 of each contactor 166 connects by a wire 222 with one end of the coil 223 of the overload relay. From the opposite end of the coil 223 a wire 224 leads to the contact 171 of the associated controller 165.

The size of the diagram necessitated the placing of the same on two sheets and on reading the diagram it is suggested that Figure 4a be placed above Figure 4b with the cables C^1, C^2, C^3, C^4, C^5 and C^6 alined. It is also to be understood in considering the description of the circuits that the cables C^1, C^3 and C^5 contain portions of the wires 213 and that the cables C^2, C^4 and C^6 contain portions of the wires 129, 225, 230 and 231. To facilitate reading of the diagram, the numerals 129, 213, 225, 230 and 231 have been applied not only to different portions of the wires but to the points where the wires enter and leave the cables and associated parts.

Figure 4a shows the limit switches 167 in the position which they assume when the carriages are traveling or moving on the elevator platform or in a storage compartment. As explained, when the carriages move to their proper position on the elevator the cams coact with the rollers 198 of the levers to rock the levers 196 and disengage the contacts 202 and 203. Thus, in order to cause any carriage to move from its proper position on the elevator platform it is necessary to short circuit the limit switch 167 associated therewith in order to energize the contactor coil 192 of the carriage motor circuit and it is for this purpose that the push button switches designated generally at 216 (see Figure 4b) are provided. Each switch 216 comprises a push button 217 for bridging contacts 218 and 219 which connect by wires 220 and 221 to the wires 213 and 129 respectively.

With the arrangement shown, however, when it is desired to start movement of any of the carriages the push button 217, associated with such carriage circuit, is depressed whereupon current flows from the positive pole 204', through the wire 141 to the elevator alinement switch 100. If this switch is closed, as it will be if the elevator is alined with a storage compartment, the current passes from the wire 141 through the contacts 102 and 103 to the wire 142, and from the wire 142 it flows through the appropriate branch 143 to the coil 192 of the proper contactor 166. After passing through the coil 192 the current flows through the wire 208, contacts 209, 211 and 212, wire 213, wire 220, contacts 217, 218 and 219 of the push button switch 216 and wire 221 back to the common return wire 129, from whence it flows back to the negative pole 204a of the knife switch 205 associated with the circuit of the particular motor to be operated.

Whenever the contactor coil 192 of any contactor is energized in this manner then the arm 193 of the contactor is drawn over into engagement with the contact 194 thereof and motor circuit proper is completed in the following manner.

The current flows from the positive pole 204 of any knife switch 205, through the associated wires 206, contact 194, arm 193, wire 222, overload relay coil 223, wire 224, to the contact 171 of the controller 165. The controller is turned in the direction which causes the segments 180 to 189 to engage the contacts 170 to 179 so that the current passes from the contact 171 over to the segment 181 and thence through wires 170' and 171' to the segments 180 and 182. As these segments 180 and 182 engage the contacts 170 and 172 part of the current passes from the contact 170 through the conventional armature shunt 191 in the usual manner and part of the current passes from the segment 182 over to the contact 172 and through the wire 225 to the brush 226 of the armature 227 of the motor 47. From the other brush 228 of the armature the current flows back through a wire 230 to the contact 173 of the controller, over to the segment 183, down through the wire 183a of the segment 184 and thence through the controller resistance 190 and wire 190a to the contact 178. From the contact 178 the current passes to the segment 188, through the wire 188a to the segment 189, over to the contact 179 and through a wire 231 leading from the contact 179 to the field 232 of the motor 47. After the current passes through the field it passes on to the

coil 233 of a conventional electromagnetic brake associated with the motor 47 in the usual manner and then travels through a wire 234 back to the common return wire 129, which leads back to the negative pole 204a of the switch 205.

As soon as the carriage begins to move the rollers 198 of the limit switch is disengaged from its cam thereby permitting the spring 201 to engage the contacts 202 and 203. As soon as this occurs the push button 217 may be released, for at that time, the path of the current through the contactor coil 192 may be completed from the wire 213 through the contacts 203 and 202 and wire 215 back to the common return wire 129. The use of a push button switch in this organization not only permits the employment of a simple yet effective means for limiting the movements of the carriage but it also makes it necessary for the operator to exercise a deliberate and conscious control of the movements of the carriage, as more fully pointed out in the co-pending application referred to.

In the other "On" position of the controller 165 the segments 180' to 189' coact with the contacts 170 to 179 in order to reverse the flow of current through the armature. In such position of the controller the current flows to the contacts 171 of the controller as before but passes over to the segment 181' where it divides, part of the current passing over to the contact 180' and through the armature shunt, and part of the current passing through a wire 182a down to the segment 182' and thence over to the contact 173 through the wire 230 to the brush 226. After traversing the armature the current flows through brush 228 and wire 225 back to the contact 172 of the controller and then passes down through a wire 174a to the contact 174. The segment 183' engages this contact 174, so that the current passes over to this segment 183' and down through a wire 175a to the segment 184' from whence it passes to the contact 175 and through the controller resistance 190 to the contact 178. The current then passes over to the segment 188' and down to the segment 189' through a wire 189a. From the segment 189' the current passes over to the contact 179 and thence through the wire 231, through the field 232 and brake coil 233 to the wire 234 and then on back through the return wire 129.

It is to be understood that the motor circuit for the motor 47 cannot be completed except when the contactor coil 192 is energized. The contactor coil 192 cannot be energized unless the contacts 102 and 103 are engaged. It is therefore a prerequisite to operation of the carriage that the elevator platform be alined with a storage compartment as the contacts 102 and 103 are not engaged unless the platform is so alined.

The elevator control circuit is illustrated diagrammatically in Figure 4b at 300 and in this elevator control circuit the contactor 110 is incorporated as above mentioned. As shown, the arm 301 of the contactor is connected with one of the wires 302 of the control circuit and is adapted to engage a contact 303 connected with the other wire 304 of the control circuit. The contactor coil is designated at 305. A spring or any other suitable means may be provided for biasing the arm 301 to open position where it is disengaged from the contact 303. Referring now to Figures 4b and 4a, one end of the contactor coil 305 connects with a wire 306 which is electrically connected with the fixed contact 307 of one limit switch 120. The movable contact 308 of this limit switch connects by a wire 309 with the fixed contact 307 of the limit switch 120 of the adjacent carriage. Similarly, the movable contact 308 of this second limit switch 120 connects by a wire 310 with a fixed contact 307 of a third limit switch 120 mounted on the third carriage. The contact 308 of the third limit switch connects by a wire 311 with the other negative pole of the switch 205a. The other terminal of the coil 305 is connected by a wire 312 with the positive terminal 204' of the switch 205a.

In other words, the limit switches 120 are connected in series with the coil 305 of the contactor 110 so that unless all of the limit switches are closed the contactor coil 305 may not be energized. However, when the carriages are properly positioned on the elevator all of the limit switches 120 are closed and the contactor coil is energized so that the arm 301 engages the contact 303 to complete the elevator control circuit. The movable contacts 308 of the limit switches 120 are biased to open position by springs or other suitable means but when the carriages are properly positioned on the elevator platform the cams 121 engage rollers 120' of the limit switches 120 to close the limit switches.

It is to be understood that the method of wiring illustrated is shown for the purpose of illustration only and various changes, additions, and omissions are contemplated within the spirit of the invention and the scope of the subjoined claims.

As disclosed in the Hendrick's application for Apparatus for handling and storing referred to above, the controllers for the motors which drive the transfer carriages and for the motors which operate the jacks of such carriages are grouped at a control station located on the platform on which the transfer carriages are normally positioned, the platform in this instance being the elevator platform. This is illustrated diagrammatically in Figure 4b where the controllers are shown grouped with the elevator control switch. As above described and shown in Figure 4a sections of the wires connecting the controllers with the various control circuits and with the motors on the carriages are embodied in cables which are automatically wound up and paid out by reels on the transfer carriages, such reels being diagrammatically shown in Figure 4a and being fully shown and described in the said Hendrick's application.

The apparatus embodying the present invention has an especial advantage when embodied in tall buildings, that is, buildings with a great many stories, for with such buildings it requires only the elevators and the transfer carriages to effect the mechanical handling of the automobiles from the receiving stations to the storage compartments and back from the storage compartments to the receiving stations. In operation, the automobiles are run into a suitable receiving station provided on the ground floor of the building near the elevators. The transfer carriages move out from the elevators under the automobiles and have their jacks engaged with the automobiles. They then run back onto the elevators carrying the automobiles with them. The elevators are run up to the level of the storage compartments in which the automobiles are to be placed and the automobiles are then run into the storage compartments under the control of the transfer car-

riage. The jacks on the transfer carriages are then lowered and the transfer carriages are run back onto the elevators.

Delivery of any car simply means a reversal of this process. Of course, where more than one automobile is stored in any compartment it may be necessary to remove the automobile adjacent the elevator well and place it in an empty storage compartment in order to get to the innermost automobile. Thus, the automobiles are handled without the necessity of anyone getting into the car and with power other than that of the vehicle itself. The safety features make it impossible for the elevator to be started up or down whenever any of the transfer carriages are in a storage compartment or not properly positioned on the elevator; and also makes it impossible for the carriages to be moved off of the elevator unless the elevator is properly alined with a storage compartment.

While transfer carriages have been shown and described as representing one means for effecting the transfer of the automobiles to and from the elevator and storage compartments, it is to be understood that any suitable transferring device may be employed which is movable across the elevator and into storage compartments and which is adapted to be run under an automobile and to be engaged therewith to propel the automobile.

The invention claimed is:

1. A garage building having tiers of storage compartments and an elevator well adjacent the storage compartments, an elevator in the well, a transfer device mounted on the elevator and movable off of the elevator into the storage compartments and back from the storage compartments onto the elevator for transferring cars directly from the elevator to the storage compartments and from the storage compartments to the elevator, a motor for driving the transfer device and cooperating means on the transfer carriage and elevator for preventing operation of the elevator at all times except when the transfer carriage is properly positioned thereon.

2. A garage building having tiers of storage compartments and an elevator well adjacent the storage compartments, an elevator in the well, a transfer device mounted on the elevator and movable off of the elevator into the storage compartments and back from the storage compartments onto the elevator for transferring cars directly from the elevator to the storage compartments and from the storage compartments to the elevator, a motor for driving the transfer device, cooperating means on the transfer carriage and elevator for preventing operation of the motor except when the elevator is levelled with a storage compartment, and means for preventing operation of the elevator at all times except when the transfer device is properly positioned thereon.

3. A garage having storage compartments, an elevator adjacent said compartments, an elevator control circuit, a transfer device mounted on the elevator and movable out into the storage compartments, and back onto the elevator, an electric motor for driving said carriage, a circuit for the electric motor, means for preventing completion of the motor circuit except when the elevator is levelled with a storage compartment, and cooperating means on the transfer carriage and elevator for preventing completion of the elevator control circuit except when the device is properly positioned on the elevator.

4. A garage having storage compartments, an elevator well, an elevator in the well, a transfer device mounted on the elevator and movable into the storage compartments and back onto the elevator, an electric motor for driving said device, a circuit for the motor, a contactor incorporated in said motor circuit, a switch mounted on the elevator and biased to open position and connected in series with the contactor and a number of cams in the elevator well for closing said switch when the elevator is alined with any storage compartment.

5. A garage having storage compartments, an elevator serving said compartments, an elevator control circuit, a transfer carriage mounted on the elevator and movable out into the compartments and back onto the elevator, a contactor incorporated in the elevator control circuit and adapted when energized to complete the elevator control circuit and when de-energized to break the same, a normally open switch mounted on the carriage and in series with the contactor, and a cam mounted on the elevator and cooperable with said switch for closing the same when the carriage is properly positioned on the elevator.

6. In a vehicle storage system, a plurality of vehicle storage stalls, rising tier on tier, an elevator having a platform travelling between the tiers and a plurality of vehicle carriers, each having a pair of spaced apart vehicle wheel guiding tracks, permanently fixed to said elevator platform each of said carriers comprising mechanism for moving a vehicle in either direction over their respective spaced apart vehicle wheel guiding tracks.

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