June 23, 1931. C. F. GODDARD 1,811,545

AUTOMOBILE STORAGE

Filed Oct. 12, 1926 2 Sheets-Sheet 1

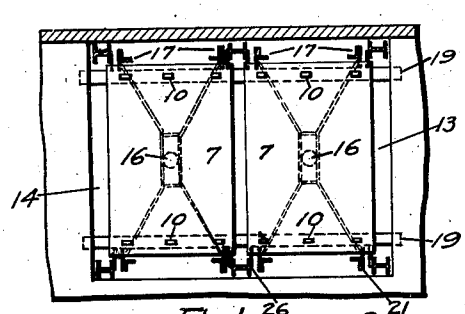



Fig. 1

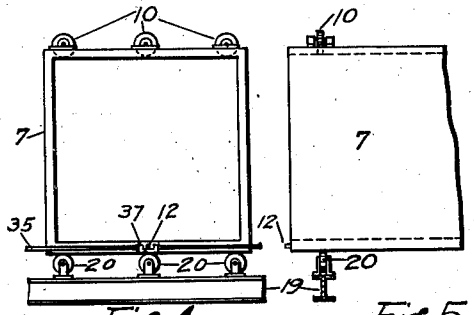



Fig. 4

Fig. 5

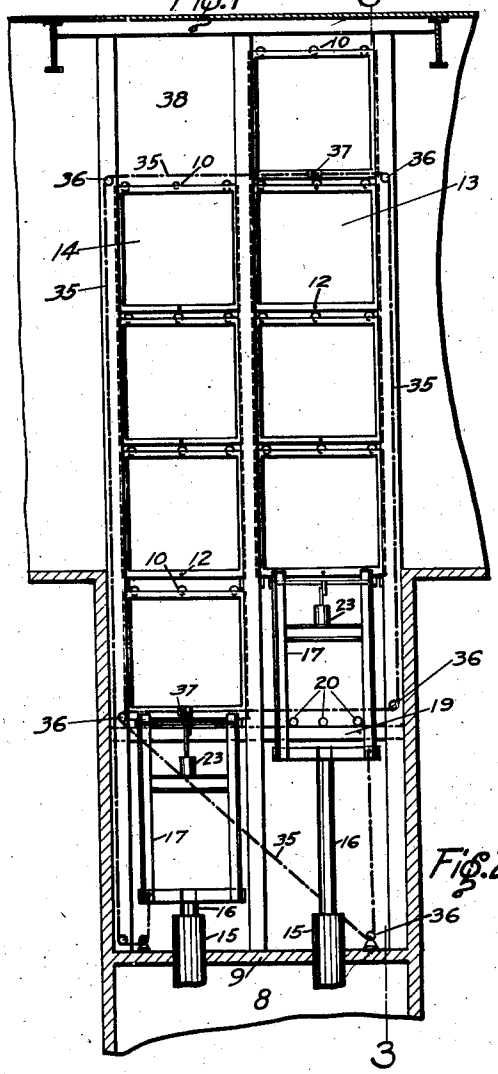



Fig. 2

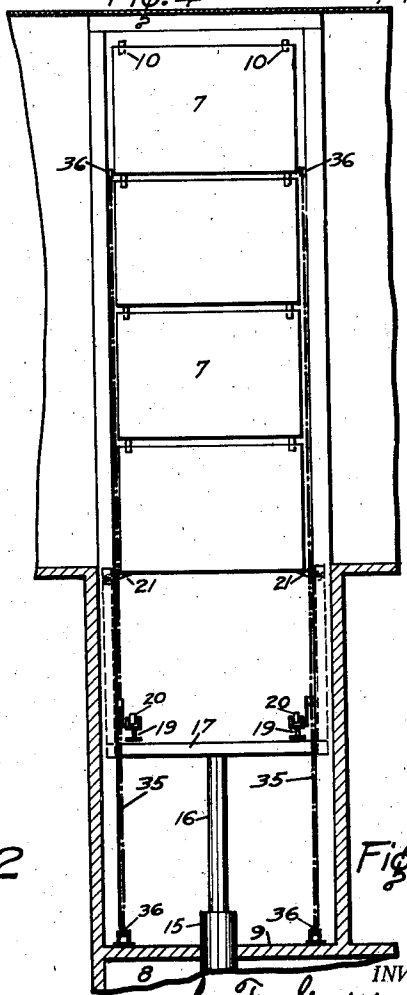



Fig. 3

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AUTOMOBILE STORAGE

Filed Oct. 12, 1926 2 Sheets-Sheet 2

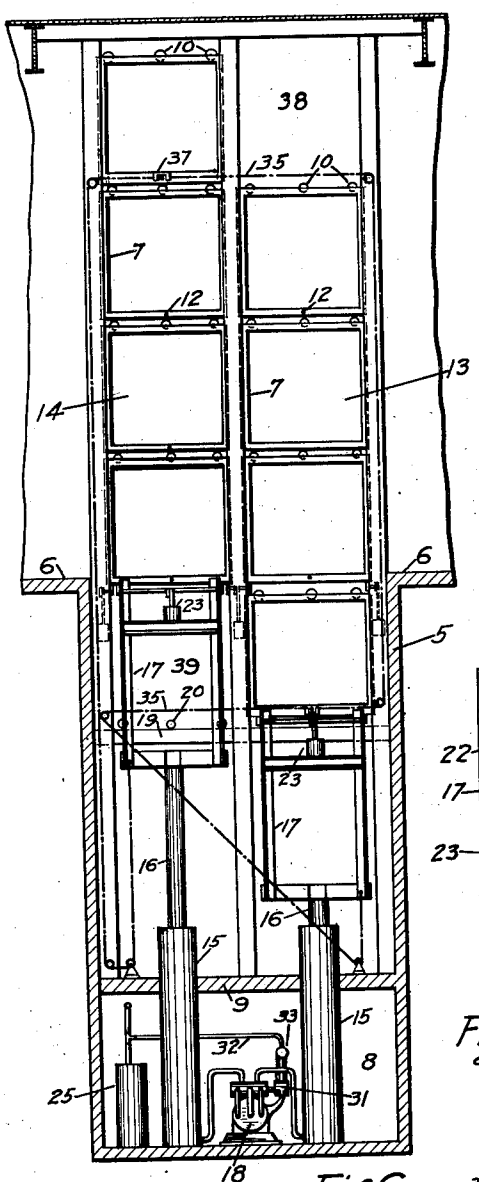


Fig. 6

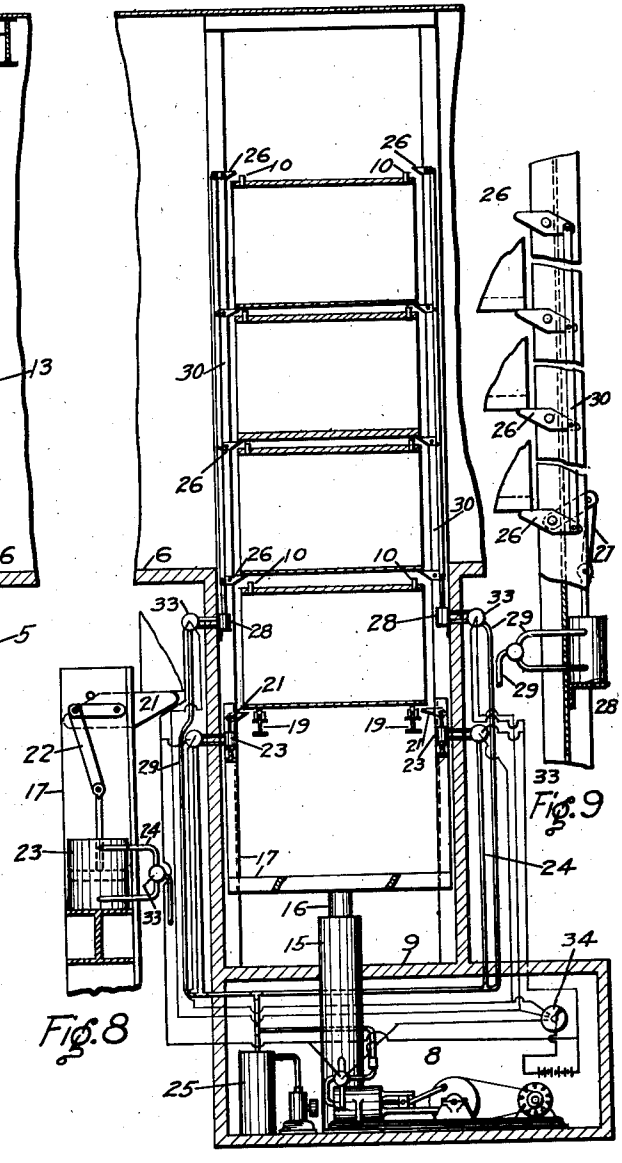


Fig. 8



Fig. 9

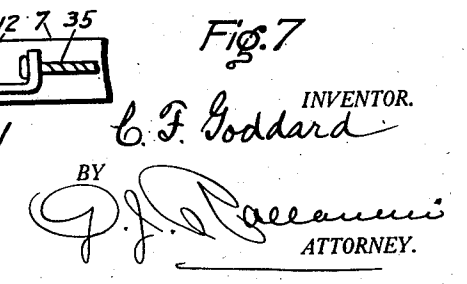


Fig. 7

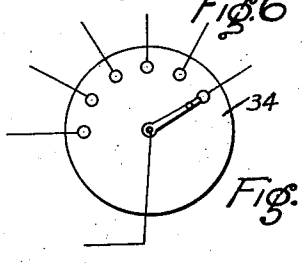


Fig. 10

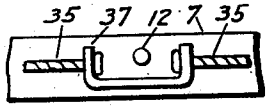


Fig. 11

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Patented June 23, 1931

1,811,545

# UNITED STATES PATENT OFFICE

CHARLES F. GODDARD, OF DENVER, COLORADO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

## AUTOMOBILE STORAGE

Application filed October 12, 1926. Serial No. 141,159.

This invention relates to automobile storage and it has for its principal object to provide an elevator system involving the use of a plurality of cages moving in two columns and shiftable from one column to another, whereby a large number of motor vehicles may be stored in a structure covering a comparatively small ground-area while all the vehicles are readily accessible for individual removal.

Other objects relating to details of construction and to novel arrangements and combinations of parts will be fully brought out in the course of the following description with reference to the accompanying drawings.

In the drawings in which similar characters of reference designate corresponding parts throughout the several views

Figure 1 represents a fragmentary sectional plan view of the structure involving the elevator-apparatus in accordance with my invention,

Figure 2, a vertical sectional elevation of the structure illustrated in Figure 1,

Figure 3, a vertical section in the plane indicated by the line 3—3 in Figure 2,

Figure 4, an enlarged elevation of one of the elevator-cages included in the apparatus,

Figure 5, a fragmentary side view of the cage shown in Figure 4,

Figure 6, a view similar to Figure 1, showing the cages of the apparatus in an adjusted position and in association with an operating mechanism in the bottom portion of their shaft,

Figure 7, a sectional elevation of the apparatus in a plane at right angles to that of Figure 6,

Figure 8 an enlarged sectional view of a dog and its controlling means, included in the construction of the lifting means of the apparatus,

Figure 9, an enlarged view of a system of dogs and their controlling means, for the support of the elevator cages in their shaft,

Figure 10, an outline view of an electric control element for the operating mechanism including the system of supporting and lifting dogs mentioned hereinbefore, and

Figure 11, a view of a portion of one of the cables included in the shifting element of the apparatus.

All of the views are more or less diagrammatic, it being understood that the novelty of the invention resides primarily in the arrangement and method of loading, elevating, shifting and supporting the vehicle carrying receptacles or cages and that the mechanisms by which these results are accomplished are subject to variation within the scope and spirit of the invention as hereinafter to be set forth and as defined in the hereunto appended claims.

Referring further to the drawings the reference numeral 5 designates a shaft or well in a building in which the system of elevators and its operating mechanism are assembled. The shaft has at opposite sides thereof a landing floor 6 on which the vehicles are moved to and from the load receptacles or elevator cages 7 and the operating mechanism is preferably installed in a chamber 8 at the bottom of the shaft, separated from the main portion of the same, by a horizontal partition 9.

The elevator cages are rectangular in form, open-ended and of sufficient size to house any motor vehicle of standard proportions. Each cage has at its top, a series of rollers 10 for the movable support of a superposed cage and it has at opposite ends of its floor, outwardly projecting pins 12 which in the operation of the apparatus cooperate with lugs on shifting cables hereinafter to be described.

The cages are mounted in two columns in vertical guide ways which divide the shaft into two adjoining sections 13 and 14 and each upper cage may be supported on the rollers of the next lower one as clearly shown in the drawings.

The operating mechanism by which the columns of cages are lifted and by which they are shifted from one shaft-section to another, may, as stated hereinbefore, be of any suitable character, that shown in the drawings consisting principally of two hydraulic rams upon which the columns are supported. Each ram has a plunger 16

mounted for reciprocation in an upright cylinder 15 and the plunger supports a skeleton head 17 which in operation engages the lower cage of the column in the respective section of the shaft.

The two cylinders of the rams connect with a pump-unit 18 by which a fluid body is transferred from one cylinder to another alternately, so that one plunger is lifted while the other one is lowered by its load in alternate movements controlled by the operation of the pump.

Extending transversely of the shaft-sections in the lower portions thereof are two pairs of horizontal beams 19, carrying antifriction rollers 20 and constituting platforms for the support of the lowermost cage of the column. At the upper ends of the upright members of the skeleton heads of the ram plungers, are pivoted dogs 21 which may be moved into and out of the paths of the elevator cages by crank-movements 22 in connection with pistons fitted for reciprocation in cylinders 23 which by means of pipes 24 are connected at opposite sides of their pistons, with an air-reservoir 25 in the chamber 8.

Pivoted on the upright guide-members of the shaft-sections at a level slightly above the top of the cages supported on the platforms provided by the cross-beams 19, are dogs 26 which likewise may be thrown into or out of the paths of the columns of elevator-cages, by crank movements 27 connected with pistons in air-cylinders 28 which at their opposite ends are by means of pipes 29 connected with the reservoir 25.

In Figure 2 has been shown one set of dogs for each shaft section which in practice supports the entire column of cages, but in Figure 7 has been depicted a modification of this construction in which the cages above the lowermost ones are individually supported on sets of dogs 26 and the dogs of the various sets are connected for simultaneous operation by means of pivoted bars 30.

The last described system is distinguished from the first described system in that the weight of the cages and their loads is distributed over a number of sets of supporting members when the elevating system is in a condition of rest, but whether the multiple sets of dogs or the single sets of dogs are used in the shaft, these dogs as well as those on the rams must be sufficiently strong to sustain the weight of all the cages in each column and their loads with a reasonable margin of safety.

The pump unit 18 is controlled by an air-cylinder 31 similar in construction to those associated with the dogs in the elevator shafts and on the ram-plungers, the cylinder 31 being connected with the reservoir 25 by a pipe 32. The flow of air through the pipes connected to the various cylinders is controlled by electrically operated valves 33 connected in electric circuits controlled by a switch 34 and this switch is constructed to close the circuit through the several valves in a determinate sequence.

The switch may, if necessary, be mechanically or electrically operated so as to move through its entire sequence of circuit-closing positions by adjustment of a single operating handle of the mechanical operating means or by closing a circuit of an electric operating mechanism as the case may be.

Neither of the mechanisms have been shown in the drawings which as stated hereinbefore, depict the operating system of the invention more or less diagrammatically and not with reference to details of construction.

The shifting element of the invention by which the cages are transferred horizontally from one column to another consists in the construction shown, of two cables 35 mounted to run over sheaves 36 and connected at their ends to the skeleton heads 17 of the two rams. The sheaves are arranged so that portions of the cables extend horizontally in planes with the bottom parts of the upper and lower cages of the two columns and these portions of the cables are provided with U-shaped lugs 37 to engage with the laterally projecting pins 12 on the cages as best shown in Figure 11 of the drawings.

Premising that the cages are in the position illustrated in Figures 6 and 7, it will be noted that in one of the columns, that at the right hand side of Figure 6, the lowermost cage rests upon the cross-beams 19, below the landing floor while the next following cage is supported on a level with the floor upon the inwardly projecting dogs 26 on the upright guide ways of the respective shaft-section. The other cages of the column may be supported upon each other and together upon the cage which rests on the dogs on a level with the landing floor, in case but one set of dogs is provided for the purpose as shown in Figures 1 and 2, or they may be supported individually on the inwardly projecting dogs when a system of interconnected dogs is employed to that end as has been shown in Figures 7 and 9.

The plunger of the ram below the column is in its retracted position and the uppermost cage of the column is below the top of the shaft at a distance therefrom substantially equal to the height of one of the cages, to provide a space 38 into which the said cage of the column may be shifted in the operation of the system.

In the other column of cages, that at the left-hand side of Figure 6, the lower-most cage is on a level with the landing floor, supported on the dogs projecting inwardly from the respective shaft-section and the other cages are sustained either upon the lower cage or upon the series of dogs pro-

jecting into the shaft as hereinbefore explained with reference to the first described column. The plunger of the respective ram is in its extended position in which the head thereof is contiguous to the bottom of the lowermost cage, the space 39 between the lowermost cage and the cross beams 19 is open to receive the lower cage of the other column which as stated before is below the level of the floor, and the uppermost cage of the column is at the top of the shaft opposite to the space 38 at the top of the other shaft-section.

The two cages which are on a level with the landing floor are in a position to be loaded with automobiles driven into their open ends from either direction and when one or both of the cages are loaded, the operating mechanism is actuated through the medium of the switch 34 to bring other empty cages in register with the floor.

The operation by which this result is accomplished is as follows: The dogs 26 in the shaft-sections are moved about their pivots to their retracted positions and the dogs 21 on the heads of the ram plungers are simultaneously moved to their inwardly projecting positions. The two columns are now supported on their respective rams and when subsequently the position of the two ram plungers is reversed by actuation of the pump unit through the medium of the valve 33, the column at the right hand side of Figure 6 is lifted to the position illustrated in Figure 2, in which its uppermost cage occupies the space 38 and its lowermost cage is brought to a level with the landing floor, and the column at the left hand side of Figure 6 is lowered until the lowermost cage rests on the rollers of the cross beams 19 and the upper cage is distanced from the top of the shaft to provide the space 38 into which the upper cage of the other column may be shifted, all as illustrated in Figure 2.

When the two columns have thus reversed their positions, the shaft-dogs are again moved to their projecting positions whereby to support the columns independent of the rams, and the dogs on the rams are at the same time retracted, which leaves the rams free for a separate operation by which the uppermost cage of one of the columns and the lowermost cage of the other column are shifted horizontally into the open spaces 38 and 39.

During the upward and downward movement of the columns the pins 12 on the upper and lower cages were separated from the U-shaped lugs 37 on the cables immediately after the cages were moved from their positions of rest, thereby permitting the cables to move with the rams without interference with the movement of the cages In order that this separation of the pins from the lugs may occur immediately after the columns have begun their movement, the lugs have been made sufficiently wide to permit of a free movement of the cable during the time the pins on the cages are separated from the lugs.

In the next step of the operation, the ram plungers, are reciprocated independently of the columns for the purpose of shifting the upper cage of the right hand column into the space at the top of the left hand column while at the same time the lowermost cage of the left hand column is moved into the space below the right hand column, all of which is accomplished by the longitudinal movement of the cables instigated by the reciprocating motion of the ram-plungers and the engagement of the lugs on the cables with the pins of the respective cages.

At the termination of this movement of the rams and the cages, the ram-plungers are returned to their original positions, as shown in Figure 6.

The operation as hereinabove described is repeated each time one or both of the cars on the level with the landing floor are loaded or whenever it is desired to withdraw a car in one of the loaded cages of either column, by bringing the cage to the level of the floor.

It will be apparent that by the use of my improved storage-system a large number of automobiles may be stored in a shaft the ground area of which is but slightly larger than the space ordinarily occupied by two of the vehicles placed side by side, that the automobiles are readily moved into the storage shaft and as easily removed from the same and that each of the cars is automatically protected against unauthorized removal as long as the cage into which it is stored is raised above the level of the landing floor.

The open-ended cage permits of cars entering or leaving the same from opposite directions and the storage system requires under ordinary conditions, the attention of but one man who controls the entire operation by means of the switch 34.

The rollers at the top of the cars and those on the cross beams greatly facilitate the horizontal movement of the cages from one column to another, but it is evident that their function in reducing friction may be obtained in other ways or that the cages may be supported directly one upon another without the intermediary of anti-friction appliances.

One of the distinctive features of the invention resides in supporting the columns of cages and their loads from below the columns, and in utilizing the supporting mechanism to lift the columns alternately as described. This feature of the invention relieves the building or other structure in which the shaft is formed, from most of the strains resulting from the weight and move-

ment of the loaded cages, in the operation of the apparatus.

While the cages have been shown and described as being open at both ends, it is to be understood that they may be open at one end only or provided with doors if necessary. It is also to be understood that the operation of the elevating and shifting mechanisms may be reversed at will, which increases the accessibility of the cages for the removal of the vehicles stored therein.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising a cylinder at the bottom of each of said vertical columns and reciprocating means for each cylinder, said cylinder having a non-elastic fluid for actuating said reciprocating means for that cylinder, said reciprocating means moving the adjacent columns of receptacles simultaneously in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column, means mounted on said means defining said vertical columns for supporting said receptacles in each column in this position, and means movable by subsequent movement of said reciprocating means for transferring the topmost receptacle in the first column laterally into vertical alinement with the receptacles in the second column and the bottommost receptacle in the second column laterally into vertical alinement with the receptacles in the first column.

2. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising a cylinder at the bottom of each of said vertical columns and reciprocating means for each cylinder, each cylinder having a non-elastic fluid for actuating said reciprocating means for that cylinder, said reciprocating means engaging the bottommost receptacle in their respective columns for moving the adjacent columns of receptacles simultaneously in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column, means mounted on said means defining said vertical columns for supporting said receptacles in each column in this position, and means movable by subsequent movement of said reciprocating means for transferring the topmost receptacle in the first column laterally into vertical alinement with the receptacles in the second column and the bottommost receptacle in the second column laterally into vertical alinement with the receptacles in the first column.

3. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means alternately moving adjacent columns of receptacles in opposite directions simultaneously until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second is entirely below the bottommost receptacle in the first column and transferring the topmost receptacle in the first column and the bottommost receptacle in the second column laterally simultaneously until they are in vertical alinement with their respectively opposite columns of receptacles, and a plurality of dogs mounted on said means defining the said vertical columns and normally disengaged from said receptacles for engaging each of said other receptacles individually to support them during the time that the topmost receptacle in the first column and the bottommost receptacle in the second column are transferred laterally to their respectively opposite columns of receptacles.

4. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means alternately moving adjacent columns of receptacles in opposite directions simultaneously until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column and transferring the topmost receptacle in the first column and bottommost receptacle in the second column laterally sumultaneously until they are in vertical alinement with their respectively opposite columns of receptacles, and a plurality of dogs mounted on said means defining said vertical columns

and normally disengaged from said receptacles for engaging each of said other receptacles individually to support them during the time that the topmost receptacle in the first column and the bottommost receptacle in the second column are transferred laterally to their respectively opposite columns of receptacles, means mounted adjacent said vertical columns for actuating all the said individual dogs for each receptacle simultaneously.

5. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means alternately moving adjacent columns of receptacles in opposite directions simultaneously until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column and transferring the topmost receptacle in the first column and the bottommost receptacle in the second column laterally simultaneously until they are in vertical alinement with their respectively opposite columns of receptacles, a plurality of dogs mounted on said means defining said vertical columns and normally disengaged from said receptacles, for engaging each of said other receptacles individually to support them during the time that the topmost receptacle in the first column and bottommost receptacle in the second column are transferred laterally to their respectively opposite columns of receptacles, and reciprocating means mounted adjacent said vertical columns for actuating all the said individual dogs for each receptacle simultaneously.

6. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising reciprocating means in each of said vertical columns for moving adjacent columns of receptacles in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column and, alternately, transferring the topmost receptacle in the first column and the bottommost receptacle in the second column simultaneously laterally until they are in vertical alinement with their respectively opposite columns of receptacles, a plurality of dogs mounted on said means defining the said vertical columns and normally disengaged from said receptacles, for engaging each of said other receptacles individually to support them during the time that the topmost receptacle in the first column and the bottommost receptacle in the second column are transferred laterally to their respectively opposite columns of receptacles, and dogs on each of said reciprocating means normally engaging the bottommost receptacle in each of said columns of receptacles for supporting the columns of receptacles respectively associated therewith during the movement of the receptacles through the vertical columns and disengaging the bottommost receptacle during the time of transfer of the topmost receptacle in the first column and the bottommost receptacle in the second column to their respectively opposite columns of receptacles.

7. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising reciprocating means in each of said vertical columns for alternately moving adjacent columns of receptacles in opposite directions simultaneously until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column and transferring the topmost receptacle in the first column and the bottommost receptacle in the second column laterally simultaneously until they are in vertical alinement with their respectively opposite columns of receptacles, a plurality of dogs mounted on said means defining said vertical columns and normally disengaged from said receptacles for engaging said receptacles individually to support them during the time that the topmost receptacle in the first column and the bottommost receptacle in the second column are transferred laterally to their respectively opposite columns of receptacles, dogs on each of said reciprocating means of said moving means and normally engaging the bottommost receptacle in each of said columns of receptacles for supporting the columns of receptacles respectively associated therewith during the movement of the receptacles through the vertical columns and disengaging the bottommost receptacle associated therewith during the time of transfer of the topmost receptacle in the first column and the bottommost receptacle in the second column to their respectively opposite columns of receptacles, and means on each

of said reciprocating means of said moving means for actuating said dogs on said reciprocating means of said moving means.

8. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising reciprocating means in each of said vertical columns for moving said adjacent columns of receptacles in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column and, alternately, transferring the topmost receptacle in the first column and the bottommost receptacle in the second column simultaneously laterally until they are in vertical alinement with their respectively opposite columns of receptacles, a plurality of dogs mounted on said means defining said vertical columns and normally disengaged from said receptacles for engaging said receptacles individually to support them during the time that the topmost receptacle in the first column and the bottommost receptacle in the second column are transferred laterally to their respectively opposite columns of receptacles, dogs on each of said reciprocating means of said moving means and normally engaging the bottommost receptacle in each of said columns of receptacles for supporting the columns of receptacles respectively associated therewith during the movement of the receptacles through the vertical columns and disengaging the bottommost receptacle associated therewith during the time of transfer of the topmost receptacle in the first column and the bottommost receptacle in the second column to their respectively opposite columns of receptacles, and means for effecting sequential operation of said moving means, said dog on said means defining said vertical columns and said dog on said reciprocating means of said moving means.

9. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising reciprocating means in each of said vertical columns for moving said adjacent columns of receptacles in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column and, alternately, transferring the topmost receptacle in the first column and the bottommost receptacle in the second column simultaneously laterally until they are in vertical alinement with their respectively opposite columns of receptacles, a plurality of dogs mounted on said means defining said vertical columns and normally disengaged from said receptacles for engaging said receptacles individually to support them during the time that the topmost receptacle in the first column and the bottommost receptacle in the second column are transferred laterally to their respectively opposite columns of receptacles, dogs on each of said reciprocating means of said moving means and normally engaging the bottommost receptacle in each of said columns of receptacles for supporting the columns of receptacles respectively associated therewith during the movement of the receptacles through the vertical columns and disengaging the bottommost receptacle associated therewith during the time of transfer of the topmost receptacle in the first column and the bottommost receptacle in the second column to their respectively opposite columns of receptacles, and an electrical switch for effecting sequential operation of said moving means, said dogs on said means defining said vertical columns and said dogs on said reciprocating means of said moving means.

10. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising reciprocating means in each of said vertical columns for moving said adjacent columns of receptacles in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column and, alternately, transferring the topmost receptacle in the first column and the bottommost receptacle in the second column simultaneously laterally until they are in vertical alinement with their respectively opposite columns of receptacles, a plurality of dog means mounted on said means defining said vertical columns and normally disengaged from said receptacles, for engaging said receptacles individually to support them during the time that the topmost receptacle in the first column and the bottommost receptacle in the second column are transferred laterally to their respectively opposite columns of receptacles, dog means on each of said reciprocating means of said

moving means and normally engaging the bottommost receptacle in each of said columns of receptacles for supporting the columns of receptacles respectively associated therewith during the movement of the receptacles through the vertical columns and disengaging the bottommost receptacle associated therewith during the time of transfer of the topmost receptacle in the first column and the bottommost receptacle in the second column to their respectively opposite columns of receptacles, an electrical switch for effecting sequential operation of said moving means, said dog on said means defining said vertical columns and said dog on said reciprocating means of said moving means, and motive means for actuating said electrical switch.

11. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising reciprocating means in each of the said columns for supporting all of the receptacles in their respective columns and moving them simultaneously in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column, and cables the opposite ends of which are attached to separate reciprocating means for engaging and moving the topmost receptacle in the first column and the bottommost receptacle in the second column simultaneously and laterally into vertical alinement with their respectively opposite columns of receptacles and operable by subsequent reversed movement of said reciprocating means.

12. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising reciprocating means in each of the said columns for supporting all of the receptacles in their respective columns and moving them simultaneously in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column, pins on each receptacle, and cables having the opposite ends thereof attached to separate reciprocating means, said cables engaging said pins on the topmost receptacle in the first column and the bottommost receptacle in the second column and moving those receptacles simultaneously and laterally into vertical alinement with their respectively opposite columns of receptacles by the subsequent reversed movement of said reciprocating means.

13. In an elevator system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising reciprocating means in each of the said columns for supporting all the receptacles in their respective columns and moving them simultaneously in opposite direction until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column, pins on each receptacle, cables having the opposite ends thereof attached to separate reciprocating means, lugs on said cables for engaging the said pins on the topmost receptacle in the first column and the pins on the bottommost receptacle in the second column, whereby subsequent reversed movement of said reciprocating means moves the topmost receptacle in the first column and the bottommost receptacle in the second column simultaneously and laterally into vertical alinement with their respectively opposite columns of receptacles.

14. In a storage system, means defining a pair of adjacent vertical columns interconnected at their respective ends, a plurality of load receptacles in each of said columns supported one upon another, means for circuitously moving said receptacles through the path defined by said columns, said moving means comprising reciprocating means for moving adjacent columns of receptacles simultaneously in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column, means mounted on said means defining said vertical columns for supporting said receptacles in this position, and means directly attached to and movable by subsequent movement of said reciprocating means for transferring the topmost receptacle in the first column laterally into vertical alinement with the receptacles in the second column and the bottommost receptacle in the second column laterally into vertical alinement with the receptacles in the first column.

15. In a storage system, a plurality of load receptacles supported one upon another in

two adjacent vertical columns, means for circuitously moving said receptacles successively through the adjacent columns, said moving means including reciprocating means for moving adjacent columns of receptacles simultaneously in opposite directions until the topmost receptacle in the first column is entirely above the topmost receptacle in the second column and the bottommost receptacle in the second column is entirely below the bottommost receptacle in the first column, and means mechanically connecting said reciprocating means with the topmost receptacle in one column and the bottommost receptacle in the other column for effecting lateral movement of these receptacles to their respectively opposite columns by subsequent movement of the reciprocating means.

In testimony whereof I have affixed my signature.

CHARLES F. GODDARD.