Aug. 9, 1932. H. D. JAMES 1,871,372

GARAGE ELEVATOR

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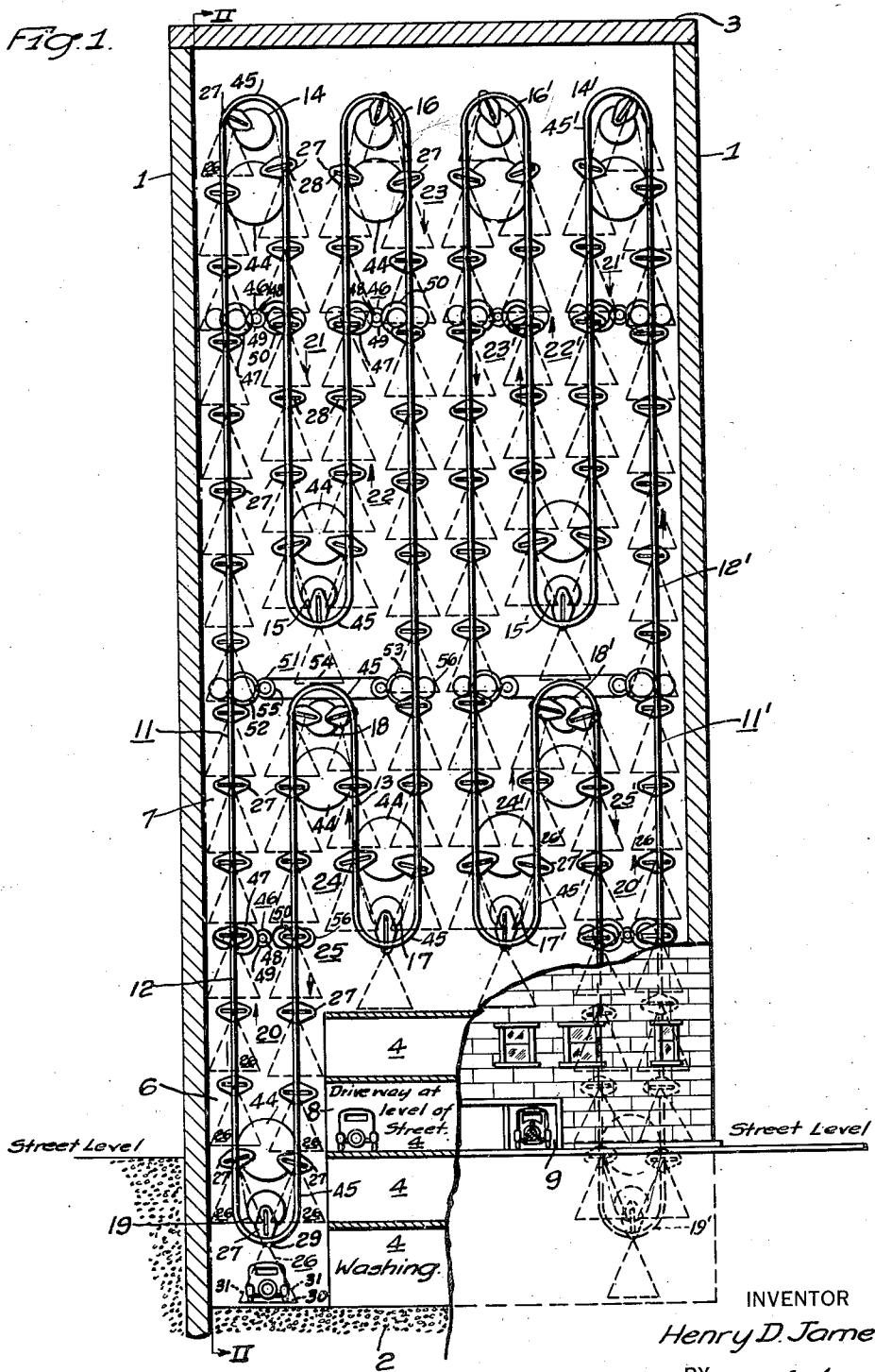
Fig. 1.



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Aug. 9, 1932. H. D. JAMES 1,871,372

GARAGE ELEVATOR

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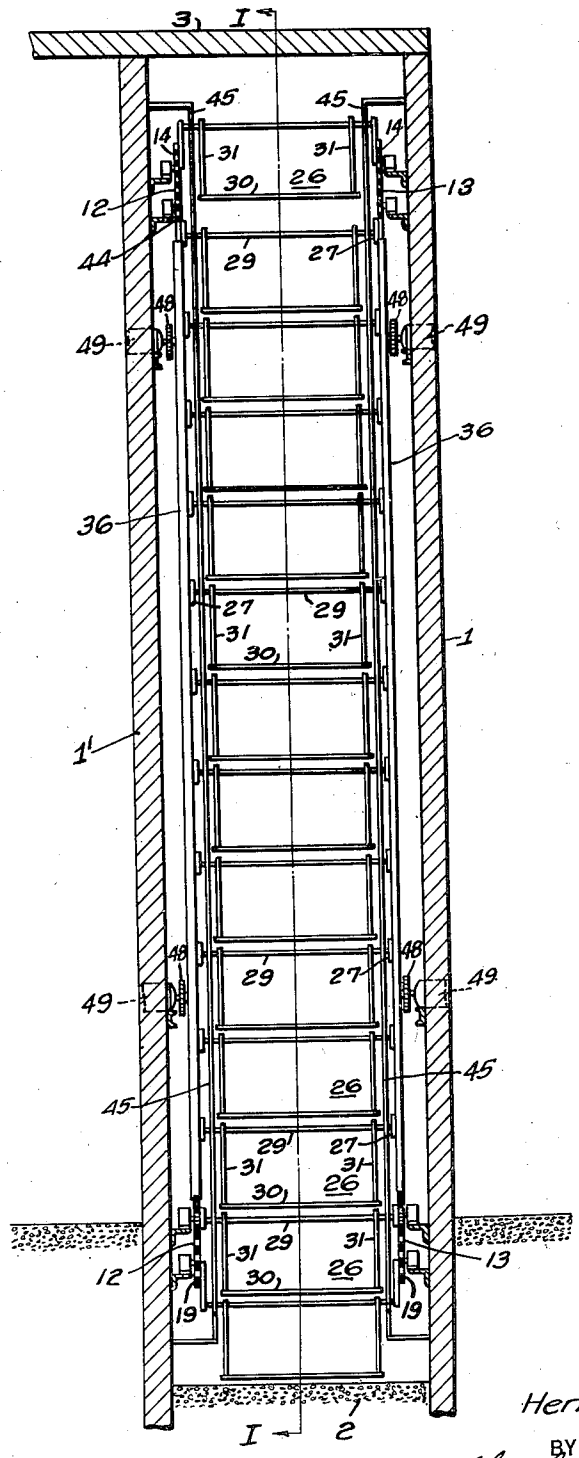
Fig. 2.



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Aug. 9, 1932. H. D. JAMES 1,871,372

GARAGE ELEVATOR

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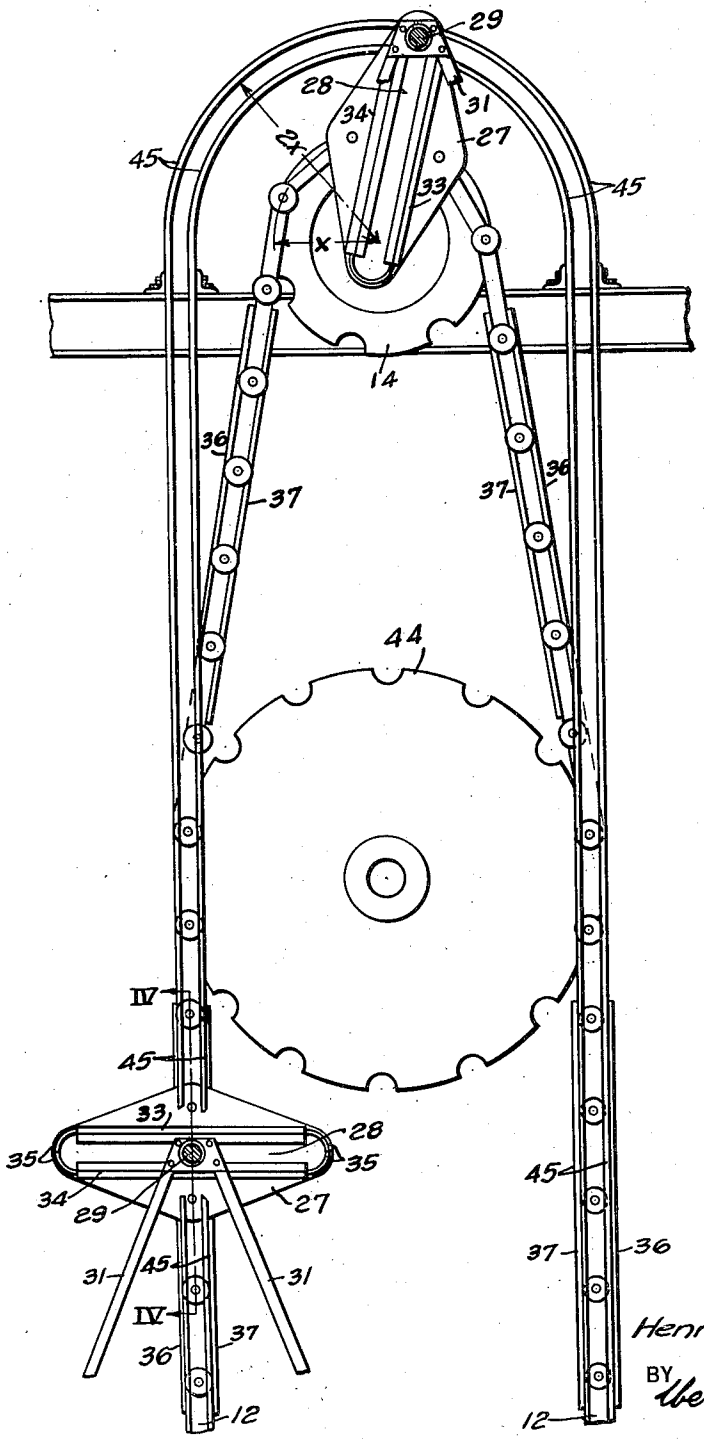
Fig. 3.



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Aug. 9, 1932. H. D. JAMES 1,871,372

GARAGE ELEVATOR

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Fig. 4.

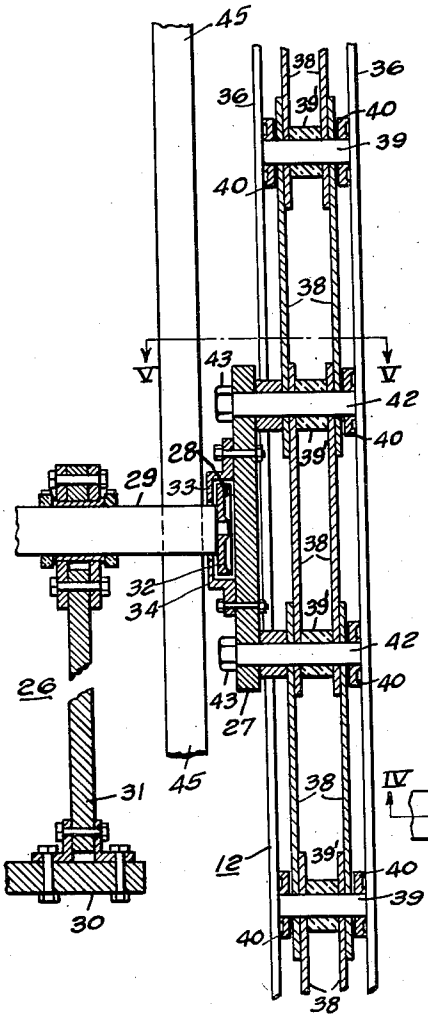


Fig. 6.

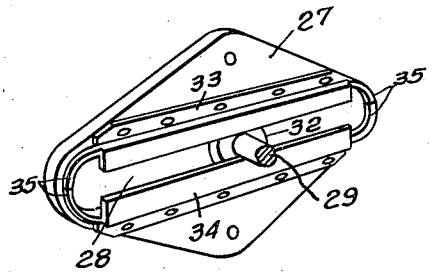


Fig. 14.

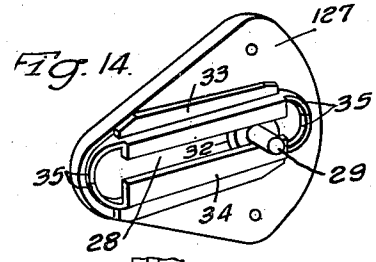
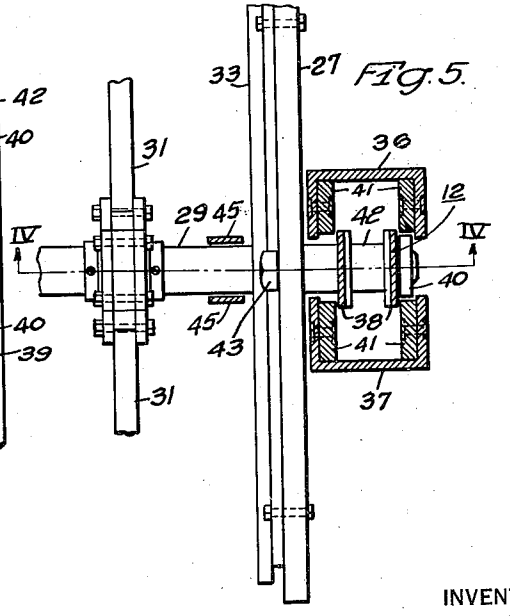


Fig. 5.



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Aug. 9, 1932. H. D. JAMES 1,871,372

GARAGE ELEVATOR

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Fig. 7.

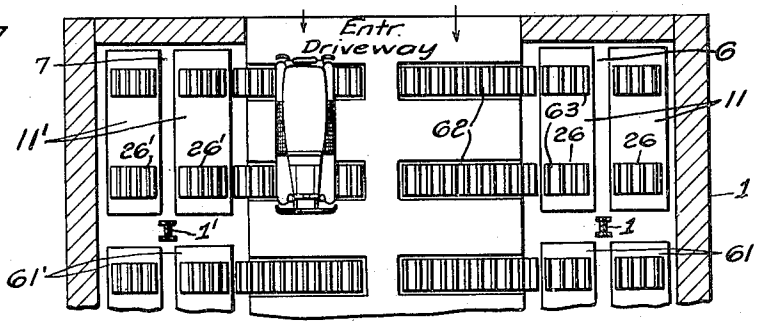


Fig. 8.

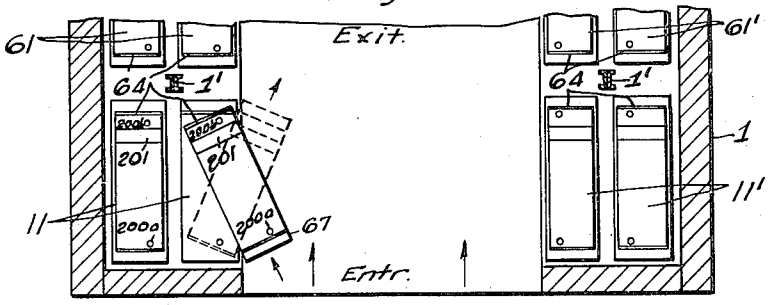


Fig. 11.

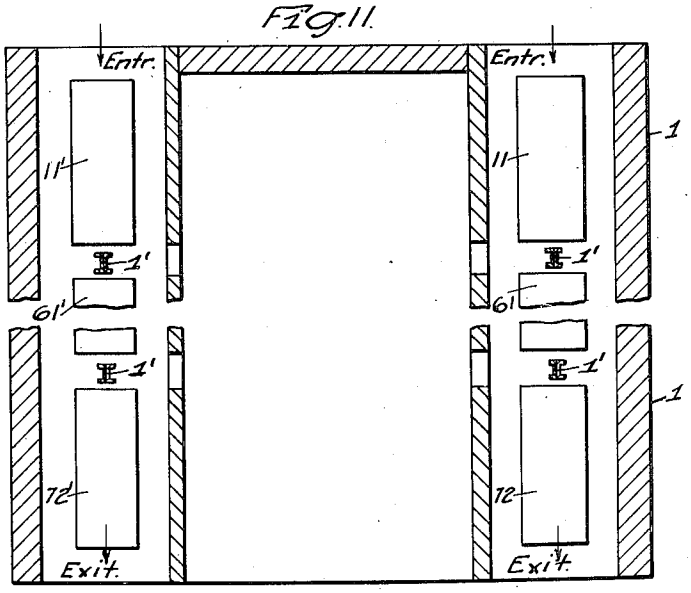


Fig. 9.

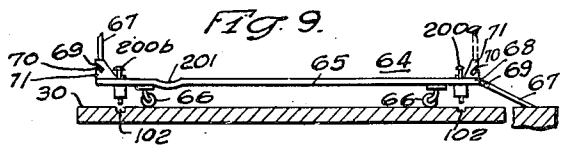
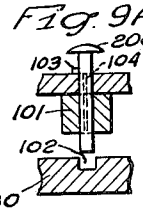


Fig. 9A.



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Aug. 9, 1932. H. D. JAMES 1,871,372

GARAGE ELEVATOR

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Fig. 10.

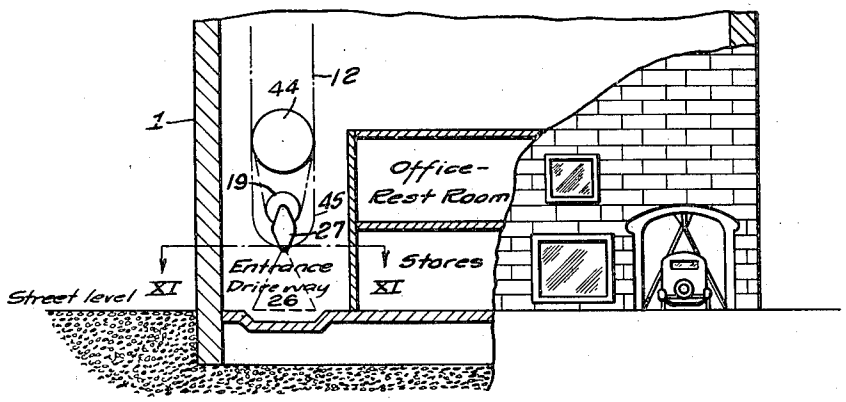
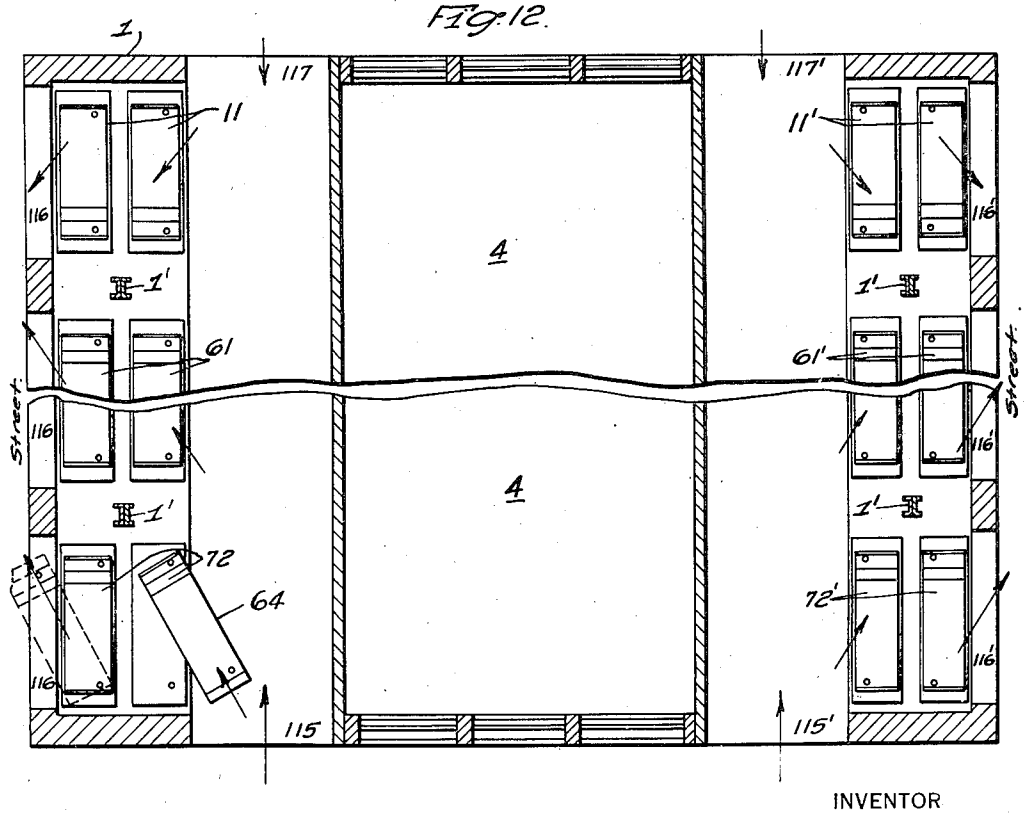


Fig. 12.



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Aug. 9, 1932. H. D. JAMES 1,871,372

GARAGE ELEVATOR

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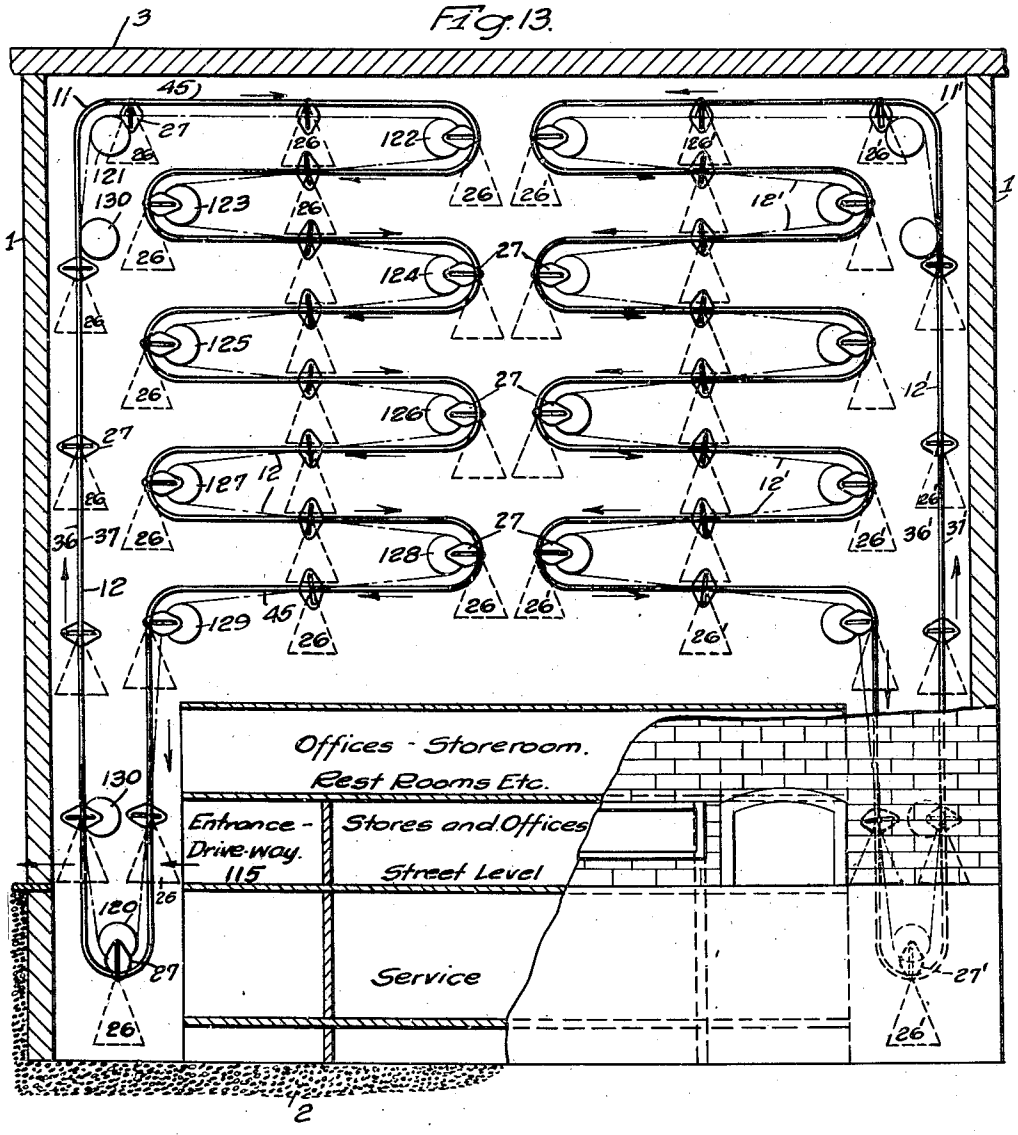
Fig. 13.



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UNITED STATES PATENT OFFICE

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GARAGE ELEVATOR

Application filed September 18, 1929. Serial No. 393,415.

My invention relates to garage elevators, particularly to garage elevators of the conveyor type and more particularly to conveyor type garage elevators utilizing a rapid-shift means to transfer the cages or receptacles from one vertical shaft to another.

The problem of automobile parking in large cities, especially in congested downtown areas, where the parking space is limited, has long been considered, and various structures have been proposed for so storing automobiles that a comparatively large number of them may be located upon a small ground area.

One of the proposed constructions is that of the conveyor-type vertical-storage elevator comprising an elevator structure in which endless flexible members or chains, having a series of automobile-supporting cages or receptacles supported thereon, may be moved around upper and lower sheaves or wheels to bring any selected cage to a loading floor. In this type of elevator, the automobiles are loaded at a lower level and either left in the cages or receptacles for storage or else unloaded at upper floors of the garage building.

All of the prior constructions have been limited to simple endless-chain structures in which the chains move upwardly in one column and down a second column and, to provide for additional storage, multiples of the simple devices have been used. Where the entire building structure is available for garage storage space, the adaptation of this simple arrangement, namely, that of a two-shaft conveyor-elevator system, is apparent.

However, in some buildings, the lower floors are desired for office space, driveways, repair floors and for other purposes, only the upper portions of the buildings being available for automobile storage. The space above the lower floors can not be utilized to advantage with the simple two-shaft conveyor in view of the fact that the automobiles must be raised at least to the height of the lower end of each of the conveyor units in order to load them on the conveyor. This necessitates a ramp or additional lifting device to bring the cars from the street level to the lower level of the storage space.

I have devised a system of storage which permits the utilization of a conveyor of the endless-chain type for such buildings, and needs no additional ramps or lifting devices but permits loading of the conveyor at the street level.

An object of my invention, therefore, is to provide a storage system of the endless-chain type in which the chain of automobile cages or receptacles moves through a convolute path occupying substantially all of the vertical cross sectional area of the housing-building structure.

Another object of my invention is to provide a storage system of the type referred to in the preceding paragraph in which only a relatively small part of the vertical cross sectional area of the building is required for loading the conveyor.

Another object of my invention is to provide a storage system of the type mentioned above in which the chain of cages moves through a convolute path including a number of vertical portions thereof.

Another object of my invention is to provide a storage system of the type described in the preceding paragraph in which the adjacent cages may be disposed close to each other during the vertical portions of their travel, but will be moved through the horizontal portions of their travel at such increased speed that the adjacent cages will clear each other during the change of direction of motion.

Another object of my invention is to provide a storage system of the endless-chain type in which the cages are laterally spaced from the path of movement of their supporting chains and in which the cages may change their positions from one side of the chain to the other with changes in the direction of motion of the cages.

Other objects will be apparent from the following description of one embodiment of my system which is illustrated in the accompanying drawings, wherein:

Figure 1 is a diagrammatic view, partly in section, of a building provided with a conveyor-type garage elevator such as I pro-

pose to use, the section being taken along line I—I of Fig. 2.

Fig. 2 is a side view of the garage elevator shown in Fig. 1.

Fig. 3 is a detail side view of the rapid-transfer mechanism which I propose to use and which is especially adapted to the new arrangements of conveyor elevators,

Fig. 4 is a sectional view of the rapid-transfer mechanism, taken on line IV—IV of Fig. 3.

Fig. 5 is a sectional view on line V—V of Fig. 4, showing the guide surrounding the chain.

Fig. 6 is an isometric detail view showing the construction of the elliptical plate embodied in the rapid transfer mechanism shown in Fig. 3.

Fig 7 is a plan view of the building structure and the arrangement of elevators in the system shown in Fig. 1, showing one system of loading automobiles on the conveyor.

Fig. 8 is a plan view of the building shown in Fig 1 having a modified system of loading the automobiles into the cages or receptacles from a central driveway entrance,

Fig. 9 is a detail view showing a form of truck such as is used in the method of loading shown in Fig. 8.

Fig. 9A is a detail view of the swivel rods on the carriage shown in Fig. 9.

Fig. 10 is a side view, in cross section, of a portion of a modified building structure and conveyor elevator system,

Fig. 11 is a plan view of the building structure and elevator system shown in Fig. 10, showing entrances, exits and a method of loading the cages,

Fig. 12 is a plan view of a modified ground-floor arrangement adapted to the system shown in Fig. 1, having side exits separate from central entrances, in order to avoid confusion of traffic.

Fig. 13 is a sectional view of a modified construction of a conveyor-elevator system and building structure,

Fig. 14 is an isometric detail view of a modification of the elliptical plate shown in Fig. 10 and which is designed for use on two-shaft-conveyor elevators .

Referring to the drawings, I have illustrated, in Fig. 1, a storage building in which the central portion of the lower part thereof is to be devoted to storerooms, repair and service facilities or to other purposes, the upper portion of the building being available for automobile storage.

The building structure comprises enclosing walls 1 rising from a foundation 2 and having a roof 3. Within the enclosing structure a plurality of rooms 4 rise from the foundation 2 in a series of floors and extending through a considerable part of the ground area of the building. The spaces 6 and 7 between the rooms so formed and the enclosing walls provide passageways extending vertically past suitable openings 8 and 9 communicating with that portion of the rooms disposed level with the street and bearing the legend "Driveway", to permit a conveyor system to be so located as to allow the automobiles to be stored to be loaded directly from the street level upon the conveyor system.

I have illustrated two substantially identical conveyor systems 11 and 11′, one of which will be described in detail, it being understood that corresponding parts of the other conveyor system are identified by primed reference characters corresponding to those designating parts of the first system.

Conveyor system 11 comprises a pair of endless chains 12 and 13 (See Fig. 2), chain 12 passing over suitable guide sheaves 14, 15, 16, 17, 18 and 19 through a convolute path including a vertical rise 20, extending throughout the height of the building, a second vertical rise 21 extending through a portion only of the building height, a third vertical rise 22 corresponding to rise 21, a fourth vertical rise 23 extending through the space between the top of rooms 4 and roof 3, a fifth vertical rise 24 extending between the rooms 4 and the lower end of rise 21 and a sixth vertical rise 25 extending downwardly to meet rise 20.

It will be understood that corresponding guide sheaves will be provided for chain 13 to guide this chain in a corresponding path.

Suspended from and between chains 12 and 13 are a plurality of load-receiving platforms or receptacles 26 of such size and shape as to readily accommodate an automobile to be stored upon the system. Each of the platforms 26 is suspended from the chain by means of a plate 27 which is, in turn, secured to, and constitutes a part of, the chain structure. The precise configuration of the attaching plate is not material, although I have illustrated the same as having a substantially elliptical form. In order that the cages or receptacles 26 may be assembled upon the endless chains 12 and 13 in as closely spaced relation as possible, to thereby permit the greatest number of platforms to be used for the length of chain utilized, it becomes necessary that special mechanism be used to permit the platforms to clear each other as they pass over the sheaves 14, 15, 16, etc. when changing the direction of motion.

It has been proposed in other devices of this character that the platforms be transferred from one vertical column to the next vertical column with a motion involving an increased speed of movement during the transfer period. This effect may be achieved in a number of ways, for example, as shown in my copending application, Serial No. 330,455, filed January 5, 1929 and assigned to the Westinghouse Electric & Manufacturing

Company, wherein the platforms are suspended at an angle to the vertical path of travel of the chain, so that, as the platforms move around the upper and lower sheaves, the platforms will be carried through an arcuate path greater than the path followed by the chain, thereby lifting the platforms out of the way during the transfer.

In the present embodiment of my invention, it is impractical to utilize the angular suspension of the platforms with reference to the chain, since, as will be observed from an inspection of Fig. 1, the convolutions of the chain prevent the attachment of the platforms on any one selected side of the chain. This will be appreciated if we assume that the platforms are to be disposed to the left of the chain during their passage through the vertical rise 20, then, during the descent in the vertical rise 21, the platforms would be on the right-hand side of the chain, making the angular attachment extend into the path of the sheave 15. Hence, it is necessary that, when the chain passes over the sheave 15, the platforms should be transferred to the opposite side of the chain.

For this reason, I have provided the elliptical attaching plate 27 with an elongated passageway or groove 28 (See Figs. 2, 3, 4 and 6) constituting a raceway to permit displacement of the cross head 29 (constituting a part of the receptacle 26) to thereby permit the platforms to be spaced from the chains on each side of the center line of the chains.

Referring to Figs. 2, 3, 4 and 5, it will be observed that each of the load receptacles or platforms 26 comprises a floor member 30 suspended from a suitable cross head 29 by means of uprights 31, the assembled structure constituting a sling upon which the automobiles may be loaded. Referring particularly to Fig. 4, it will be observed that the outer end of the cross head 29 is provided with a roller 32 which operates in the groove 28 in the elliptical plate 27.

While the plate 27 may be made in any well known manner, I have illustrated the same in Fig. 6 as having attached thereto, in any suitable manner, a pair of angular members 33 and 34 which may be constructed of commercial Z-bar steel structural members, mounted upon the plate 27 in parallel relation to provide therebetween a trackway for the roller 32. In order that the roller may be positively prevented from moving entirely out of engagement with the passageway, I have illustrated the outer ends 35 of the angular members 33 and 34 as being cut away and bent inwardly toward each other to constitute an end closure for the passageway.

Referring to Fig. 5, it will be seen that the chain 12, supporting the platforms 26, moves within a guideway framed between guide channel members 36 and 37 which insure the proper alignment of the chain during its passage through the convolute path previously described.

While the chain may be constructed in any suitable manner, I have illustrated it as comprising a plurality of links 38 inter-engaged at their ends and held together by means of pins 39, the outer ends of the pins 39 being provided with guide rollers 40 to engage suitable noise-eliminating guide linings 41 secured within the guide channel members 36 and 37. A bushing 39′ may be provided upon the pins 39 for the double purpose of spacing the links of the chain and for providing a friction-reducing contact with guide sheaves 14 etc., as will hereinafter be more fully explained. At the points along the chain structure at which the elliptical plates 27 are to be attached, pins 42, similar to pins 39, are utilized, which pins, however, are of considerably greater length than the pins 39, so that the ends of these pins may project through, and be attached to, the plates 27 in any suitable manner, for example, by means of a threaded nut 43. While the plate 27 may be of sufficient size and strength to constitute the section of the chains between the supporting pins 43, the resultant bending stress upon the pins 43 may be eliminated by providing additional chain links 38 between these pins as well.

Referring to Figs. 1 and 3, it will be observed that the portions of chain 12 in the vertical rise 20 and in the vertical rise 21 are held normally spaced from each other by just such distance as will allow the ascending platforms 26 in one vertical column or rise, to clear the descending platforms in the next rise during the vertical portions of travel, by means of guide sheaves 44 of somewhat larger diameter than sheaves 14, 15, etc. Hence, during the major portion of the vertical travel in any of the vertical rises 20, 21, etc., the ascending and descending portions of the chain 12 will be considerably spaced apart, while, as the chain nears the ends of the vertical rises, the horizontal spacing of the chain portions is considerably reduced.

Referring particularly to Figs. 4 and 5, it will be observed that additional guide members 45 are provided, one on each side of the cross head 29, for the receptacles 26, so that, as the chain moves through the angular path between the guide sheaves 44 and the guide sheaves 14, etc., the cross head 29 will follow a vertical path in alignment with the previous vertical movement of the chain. Between the sheaves 44, however, the additional guide members 45 are in horizontal alignment with the guides 36 and 37 for the chain, so that, during the major part of the vertical travel through the vertical rises, the cross head 29 and its roller 32 will be maintained at the center of the elliptical

plate 27, but, when the cross head has moved upwardly beyond the center line of the guide sheave 44, the cross head will be moved outwardly from the center, as the chain follows the converging path. In this way, platforms though suspended from a point in the same plane as the chain during the vertical motion, are caused to be laterally spaced from the path of movement of the chain at the ends of the vertical rises, and the cross head 29 is caused to move through an arc greater than the arc through which the chain moves over the sheave 14.

The guide members 45 are continued through an arcuate path concentric with the guide sheave 14 so that the cross head is positively guided through the entire transfer period to again align the cross head with the vertical portions of the chain during the descent in the next vertical rise.

The construction set forth provides a system for transferring the cages from one vertical rise to the next in such manner as to cause the cages to clear each other without difficulty, even though the cages are spaced upon the chain in close relation. For example, assuming the radius of the sheave 14 to be X, it will be observed that, by making the radius of the arc described by the guides 45 twice the radius of the sheave 14, the horizontal component of the movement of the cages will be increased at substantially twice the speed of the horizontal component of the movement of any given section of the chain over the guide sheave 14, and the peripheral speed of the cross head 29 will be substantially twice the peripheral speed of the sheave 14, thereby accomplishing the transfer of the cages from one vertical rise to the next at substantially twice the speed of movement of the chain through the arc described by the sheave 14. It will, therefore, be seen that, during the transfer from vertical rise 20 to vertical rise 21, the movement of the cages is first accelerated and then decelerated to coincide with the movement of the chain.

In like manner, when any one of the cages descending in the vertical rise 21 arrives at the point of passage around the sheave 15, the guide members 45 will cause movement of the cross head from the center of the suspending plate 27 to the opposite end of the plate 27, thus providing for the rapid transfer of the cages during reversal of movement at the sheave 15.

It will, therefore, be readily seen that I have provided a conveyor system in which the transfer of the cages may be accomplished without interference between the cages, even though the direction of travel may be changed in different directions to conform to a convolute path.

Any suitable driving means may be provided for the conveyor systems to cause the load receptacles or platforms to move over the convolute path defined by the guide sheaves. However, I have illustrated one type of drive comprising a plurality of driving units 46 distributed throughout the vertical portions of the path. Each of the driving units 46 preferably includes a sprocket 47 meshing with the chain 12 and connected for rotation by means of suitable reduction gearing 48 to a motor 49. From an inspection of Fig. 1 it will be observed that the sprocket 47, engaging the chain 12 in the vertical rise 20, is directly geared to a similar sprocket 50 engaging the part of chain 12 in the vertical rise 21. Hence, the motor 49 which is utilized to move the chain upwardly in rise 20 also acts to move the chain downwardly in rise 21. Hence, the weight of the receptacles and their loads are balanced at each drive unit, the motor having only to move the unbalanced load.

In this manner, the load on the chain is so distributed that the chain need only have sufficient strength to support the load represented by the greatest number of platforms between any two drive units 46.

However, at those portions of the convolute path in which the ascending and descending parts of the chain are spaced a considerable distance apart, for example, between rise 20 and rise 23, there may be supplied a special drive unit 51 comprising a sprocket 52 engaging the chain 12 in rise 20 and a second sprocket 53 engaging the chain in rise 23, both connected for simultaneous rotation by means of any suitable gearing, shafting or belting 54 to a motor 55. In this manner, the difficulties of balancing the load on the longer vertical rises may be surmounted.

It will be noted that the driving units apply force to the chain in what may be termed a tangential gear drive. Hence, some means must be provided to prevent the lateral thrust of the sprockets on the chain from moving the chain out of engagement with the sprockets. This device may comprise a disk or wheel 56 bearing on the chain on its side opposite to that engaged by the sprocket. A thrust-absorbing device of this type will provide a rolling contact with the chain and will exert no appreciable retarding effort upon it.

The storage system thus far described will best be understood with reference to an assumed operation. Assuming that an automobile has been driven through the entrance to the garage and has been placed in front of the opening 8 at the driveway level, the car may be loaded upon one of the platforms 26.

The drive units 46 may then be started through the manipulation of any suitable electrical control system for the motors 49,

and the entire conveyor 11 will be started to move the loaded receptacle 26 away from the driveway entrance 8. Assuming that another automobile is to be stored, the next platform or receptacle in succession upon the chain 12 may be moved to a position level with the driveway, and the second automobile be stored upon this platform. This operation may be repeated until all of the platforms have been loaded with automobiles to be stored.

Let it be assumed that, upon starting the drive units 46, the first of the platforms 26 to be loaded is moved downwardly past the opening 8. The movement of the chain 11 will cause the platform to continue its downward movement to the limit of travel defined by the position of the sheave 19. However, as the chain passes the central line of the guide sheave 44, the chain 12 will be moved inwardly along the converging path to meet the periphery of the smaller sheave 19. The attachment plate 27 will, consequently, be moved out of the vertical line along which the chain had been traveling, but guide members 45, engaging the crosshead 29 of the platform 26, will cause the crosshead to move from its center position in the plate 27 toward the right-hand end of the plate 27 to thus permit the crosshead to follow the path defined by the configuration of the guides 45. Hence, while the chain travels through the relatively short path around sheave 19, the crosshead 29 of the platform 26 will be moved through the longer path and, as hereinbefore explained, this path having a radius equal to twice the radius of the sheave 19, the motion of the platform 26 will be accelerated, and the platform will be moved through the arc described by guides 45 with a more rapid motion than that of the center point of the attachment plate 27. As the center point of the attachment plate 27 passes the vertical center of the guide sheave 19, the guides 45 will tend to move the crosshead inwardly to again aline the crosshead with the center of the plate 27, and the platform 26 will be again alined with the direction of movement of the chain 12 as it starts upwardly in the vertical rise 20. This rapid transfer motion will be repeated as the platform 26 passes over sheaves 14, 15, 16, 17 and 18 at each change in direction of movement of the chain to follow the convolute path through which this chain moves to thereby bring the platform back to the loading level. It will be observed, from the foregoing description of the operation of the conveyor 11, that the continuation of the chain 12 through the vertical risers 22, 23 and 24, all alined in the vertical plane above the storerooms, offices, driveway, repair and service floors, etc., permits the utilization of one-half of all of the available space within the vertical cross-section of the storage structure 1.

In a similar manner, the second conveyor 11′ permits the utilization of all of the remaining half of the vertical cross-sectional area of the storage building available with the platforms on both conveyors spaced relatively close to each other during all of that portion of their travel which is directly vertical and yet permitting the spacing of the platforms to be increased by such amounts as are necessary to allow the platforms to clear each other as they pass from one vertical rise to another.

It will, therefore, be seen that, by constructing the conveyor system to follow the convolute path described, the particular shape of the vertical cross-section of the building is no longer material, as limiting the number of automobiles which may be stored within such building.

Multiples of the storage conveyor units 11 and 11′ may be disposed throughout the depth of the storage building 1, as is illustrated in Figs. 7, 8 and 11, wherein a plurality of storage units are arranged on the right-hand side of the entrance driveway, identified by the legend "driveway", one conveyor being indicated by the reference character 11, the next in line being indicated by the reference character 61, while on the left-hand side of the driveway conveyor 11′ and a similar conveyor 61′ are indicated as arranged adjacent to each other. Similar units (not shown) may be disposed in like manner to completely fill the depth of the building housing 1.

While any suitable method of loading the automobiles upon the platforms 26 may be utilized, I have illustrated, in Fig. 7, one method of moving the automobiles from the entrance driveway to the platforms 26 without the necessity of turning the automobiles. Located within the housing structure 1 and in alinement with the entrance driveways adjacent to each of the storage units 11, 61, etc., are a pair of endless belt conveyors 62, each of which may be disposed, in any well-known manner, to permit movement of articles placed thereon in either the left-hand or the right-hand direction.

A similar pair of endless belts 63 are mounted upon each of the platforms 26 to permit movement of articles placed therein in either the right-hand or the left-hand direction. By locating the ends of such conveyor belts relatively close together, it will be apparent that an automobile driven upon the pair of conveyor belts adjacent to conveyor system 11 may readily be moved to the left and upon the conveyor belt 63 to the particular platform 26 of that conveyor system which is to be loaded. In like manner, when it is desired to remove an automobile from a platform 26, it may readily be moved to the right and upon the conveyor belts 62 to again aline the automobile with the entrance driveway. In this way, the platforms

may be loaded without unnecessary turning or other manipulation of the automobiles to be stored.

In Fig. 8, I have illustrated a modified form of loading device for an automobile-storage system of the type illustrated in Figs. 1 to 6 in which the building enclosed by the walls 1 has located therein a conveyor system 11 and a second conveyor system 61 suitably disposed along the depth of the building.

Each of the conveyor systems 11 and 61 comprises a plurality of platforms 26, such as are illustrated in Fig. 1, upon which automobiles are to be loaded. Additionally, however, each of the platforms 26 is provided with a movable carriage 64 which may be moved on and off the associated platform 26.

Referring to Fig. 9, one form of the construction of such a carriage is illustrated as comprising a base 65 suitably supported upon rollers or casters 66 disposed to permit movement of the carriage 64 in any direction. For the purpose of insuring a definite path of movement of the carriage, in moving from the receptacle to the loading or unloading platform, and also for the purpose of serving as a locking means to retain the carriages on the elevator cages in the supporting structure, swivel rods 200*a* and 200*b* are provided. The swivel rods 200*a* and 200*b* are mounted in suitable bushings 101 (See Fig. 9A) secured to the floor of the carriage at the proper points, perpendicularly to the floor of the carriage to extend through the floor of the carriage to engage a suitable depression or opening 102 in the floor of the elevator cage or receptacle. The rods are slidably movable manually perpendicular to the floor of the carriage and the floor of the elevator cage and have a lug 103 slidable in a groove 104 in the engaging bushing on the carriage which serves to retain the rod in a raised or disengaged position with reference to the floor of the elevator cage when the swivel rod is turned or rotated after it has become disengaged from the groove in which it slides and reaches the top of the groove in the bushing in which it is mounted. Depression 201 in the floor of the carriage is provided so that the front wheels of the automobile engage it, and the automobile is retained in a fixed position on the carriage.

Referring again to Fig. 8, it will be observed that an automobile to be stored upon the platform 26 may be driven to a position just in advance of the platform, at which time the movable carriage 64 may be swung angularly off the platform, pivoting about the swivel rod 200*b*, it being necessary only to move one end of the carriage 64 entirely off the receptacle to the position illustrated in Fig. 8, after raising the swivel rod 200*a* and disengaging it from the floor of the elevator cage, since, by slightly turning the front wheels of an automobile, it may readily be driven upon the carriage 64. To facilitate the driving of the automobile upon the carriage 64, an end plate 67 may be pivoted to the base 65 of the carriage at some such point as is represented by the character 68. The end plate 67, when moved outwardly from the base 65, will rest upon the floor of the entrance driveway to constitute an inclined ramp by which the automobile may readily be driven upon the base. After the automobile has been moved upon the base 65, the end plate 67 may be raised into the position shown in dotted lines in Fig. 9 to engage a pin 69 in a slot 70 upon an upright 71 rigidly secured to the base, the engagement of pin 69 and the slot 70 constituting a lock to prevent the plate 67 from falling outwardly. Since the arrangement of the plate 67 is such as to aline with the wheels of the automobile when it is to be driven upon the base 65, it will be readily seen that, when raised and locked in the upright position, the plate 67 will function as a lock, in addition to the depression 201, to hold the automobile against movement upon the carriage 64.

After the automobile has been moved upon the carriage 64 and locked thereon, the end of the carriage which had been swung outwardly may be swung inwardly upon the platform 26, secured therein by the reengagement of swivel rod 200*a*, with the depression in the floor of the elevator cage, thus permitting the platform 26, the carriage 64 and the automobile now located thereon to be moved around the convolute path described by the conveyor system.

In unloading an automobile from the elevator cage, the swivel rod 200*b* is disengaged, and the carriage is swung out, with swivel rod 200*a* as a pivot, the opposite end of the carriage now projecting out into the driveway. The hinged member 67 on that end is let down to the floor of the driveway, and the automobile is then driven, directly from the carriage 64, into the driveway and out of the building by an exit at the other end of the driveway from the entrance to the building.

While such methods of side loading as have been described with reference to Figs. 7, 8 and 9 are easily adapted to conveyor-type elevators, it will be apparent that other schemes for loading the automobiles upon the platforms may be utilized. For example, in Fig. 10, I have illustrated a somewhat different arrangement of the conveyor systems in a building in which all of the portions of the conveyor systems lie above the street level to permit the driving of an automobile directly from the street upon the receptacles 26, through the ends thereof.

Referring to Fig. 11, the floor plan of the storage system adaptable to the type of building illustrated in Fig. 10 is shown wherein a plurality of storage units 11, 61 and 72 are

shown disposed in alinement throughout the depth of the building structure and, in addition, disposed in alinement with the entrance driveway leading from the street. It will readily be seen that the automobile may be driven directly from the street upon the platforms 26, constituting portions of each of the conveyor units. With this type of floor plan, however, it is necessary that one of the platforms 26 in each of the converter units shall be kept unloaded so that it may be alined with similar unloaded platforms in the remaining conveyors to constitute a driveway through which the automobiles may pass in being loaded upon any one of the conveyor units. By arranging an exit at the opposite end of the building, it will be readily seen that there will be no interference between incoming and outgoing vehicles to be respectively loaded upon, and taken out of, the conveyor systems.

A further modification of a floor plan adaptable for use with the conveyor system shown in Figs. 1 and 2 is shown in Fig. 12. In this modification, the entrances and exits are separated, the entrances being in the central portion of the front and rear of the building, whereas the exits are through the side walls of the building past which the conveyor system moves.

In this modification, some method of side loading is necessary. I have shown one of the methods of side loading, previously described, in which the swiveling platform or truck is used but this is not material in the operation of this particular floor-plan modification.

In the floor plan shown in Fig. 12, the automobiles enter the building through the entrance ways 115 and 115′ in the front of the building and 117 and 117′ in the rear of the building. Obviously, where a number of conveyor systems, as, for example, 11, 61 and 72, extend through the depth of the building, the necessity for driving from the front of the building to a conveyor in the rear of the building is obviated by having an automobile enter by an entrance-way much closer to the particular conveyor system upon which it is to be stored. The automobile is driven directly upon the platform or truck 64 of any of the conveyor systems 11, 61 and 72 or 11′, 61′ and 72′, subsequently being loaded upon the conveyor system, as previously described. In removing an automobile from its parked or stored position, the conveyor system is moved until the supporting receptacle is in alinement with the exit openings 116 in the side walls, the platforms are swivelled out, the hinged members are let down and the automobile is then driven directly out of the building into an adjacent driveway or street. The exits cooperating with the conveyor systems 11′, 61′ and 72′ are indicated as exits 116′ in the side walls of the building.

A modification of the conveyor systems 11 and 11′ in a building structure is shown in Fig. 13. The essential difference between this structure and that of Fig. 1 is that the conveyor systems 11 and 11′ comprise the combination of a series of horizontal paths and vertical paths instead of all vertical paths, as in Fig. 1. It will be understood that the two conveyor systems 11 and 11′ of this modification are exactly alike in structure and operation so that points of difference will be pointed out for the conveyor system 11 only.

The cages or receptacles 26 are supported in exactly the manner described for Fig. 1, from the endless-conveyor chains 12 by means of the slotted or grooved plates 27 which effect the rapid transfer movement of the cages or receptacles from one horizontal or vertical path to another. In Fig. 13, the endless chains 12 move through guide members 36 and 37 and around the sheave wheels 120, 121, 122, 123, 124, 125, 126, 127, 128 and 129 successively. Guiding members 45 are provided for the cross head 29 of the receptacles. and are similar to those shown in Fig. 1. In Fig. 13, the guiding members 45 follow substantially a path similar to the path taken by the endless chains 12. It will be noted that, throughout a major part of the travel of the cages, that is, during the times the cages or receptacles are moving in the horizontal paths, the entire weight of the cages is carried by the guides 45 so that the endless chains 12 are not subjected to the continuous load that they are in system shown in Fig. 1. The spacing wheels 44, it will be observed, are not necessary in the modification shown in Fig. 13 but the sprocket wheels 130 suitably mounted upon the supporting structure 1 are required, in this modification, to effect the converging path of the endless chain 12 with respect to the sheave wheels 120 and 121, the converging path of the endless chain 12 being necessary to effect the lateral movement of the receptacles 26 during the rapid transfer movement.

It will be understood that any of the systems of loading the automobiles upon the conveyor systems may be applied or adapted to the modification shown in Fig. 13. I have shown the floor plan as described in Fig. 12 adapted to the modification shown in Fig. 13, but this is not essential or material to the operation of the conveyor system.

A modification of the slotted or grooved plate 27 is shown in Fig. 14. This plate 127 has a slot or groove 28 constituted by two bar members 33 and 34 suitably attached to the plate. The groove 28 extends laterally, on one side only, from the line or support of the plate 127 which coincides with the line of movement of the chain to which the plate is attached. In other respects, the construction and operation of this modification is essen-

tially the same as that for the plate shown in Fig. 6.

This modification of a slotted or grooved plate to effect lateral movement of the cages or receptacles from the endless chain to which the plates are attached, is especially adapted for use with an endless conveyor having but two straight paths of movement connected at their respective ends by curved portions, that is, a conveyor system similar to a loop. Obviously, in transferring from one straight path to the other in a conveyor system of the loop type, and using a rapid transfer plate, movement of the cages or receptacles laterally from one side only of the endless chain is necessary. It should be understood that the slotted or grooved plate 27 shown in Fig. 6 is equally as adaptable in either the convolute or the loop-path conveyor system, but, as a matter of economic construction, a slotted plate of the type shown in modification illustrated in Fig. 14 is all that is required in a loop conveyor.

It will thus be seen that I have devised an automobile-storage system which adapts a circuitous conveyor system to various types of building structures, in such manner as to utilize all available volume of the building structure for live storage of automobiles. It will also be seen that my invention comprises a rapid transfer device or mechanism which is especially adapted to the circuitous conveyor systems in that movement of the cages laterally from the line of movement of the endless chains comprising the conveyor system in either direction is effected.

It will be understood that the described embodiment of my invention is illustrative only and I do not desire to be limited to any of the details shown herein except as defined in the appended claims.

I claim as my invention:

1. In a storage system, a housing structure, an enclosure within said structure for enclosing a portion of the lowermost part thereof and defining a relatively narrow passageway connecting the lower part of the structure and the unenclosed upper portion thereof, and a conveyor system in the upper portion adapted to move through a path including a plurality of convolutions, one of which convolutions extends through the said passageway to the lower part of said building.

2. In a storage system, a housing structure, an enclosure within said structure for enclosing a portion of the lowermost part thereof and defining a relatively narrow passageway between the lower part of the structure and the unenclosed upper portion thereof and a conveyor system, including a plurality of endless conveyor units, in the unenclosed upper portion, each adapted to move through a path including a plurality of convolutions, one of which convolutions extends through the said passageway to the lower part of said structure.

3. In a storage system, a housing structure, an enclosure within said structure for enclosing a portion of the lowermost part thereof and defining a relatively narrow passageway between the lower part of the structure and the unenclosed upper portion thereof, a loading station in the lower part of the building adjacent to said passageway and a conveyor system in the unenclosed portion of said structure adapted to move through a path including a plurality of convolutions, one of which convolutions extends through said passageway to the loading station.

4. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous circuitous path of movement for said conveyor element having parallel spaced-apart straight portions and converging portions connecting the ends of said straight portions, a plurality of load receptacles and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from said conveyor element when the portions of the conveyor element to which the receptacles are attached pass through the converging portions of said path and guiding means engaging said receptacles and defining the entire path of movement of said plurality of receptacles and effecting lateral movement of said receptacles to displace them from said conveyor element during the movement of the portions of said endless conveyor element to which said receptacles are attached through the converging portions of the path of movement of the conveyor element.

5. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous convolute path of movement for said conveyor element having parallel spaced-apart straight portions and converging portions connecting the ends of successive adjacent straight portions, a plurality of load receptacles and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from either side of said conveyor element and guiding means engaging said receptacles and defining the entire path of movement of said plurality of receptacles and effecting lateral movement of said receptacles to displace them from either side of said conveyor element during movement of the portions of said endless conveyor element to which the receptacles are attached through the converging portions of the path of movement of the conveyor element.

6. In a conveyor system, an endless flexible conveyor element, supporting means

therefor defining a continuous circuitous path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of the straight portions, a plurality of load receptacles and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from the said conveyor element and guiding means having straight portions in alinement with the straight portions of the path of movement of said conveyor element and arcuate portions connecting the straight portions but not in alignment with the converging portions of the path of movement of the conveyor clement, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element to which the receptacle is attached moves through the converging portions of the path of movement of the conveyor element.

7. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous convolute path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of successive adjacent straight portions, a plurality of load receptacles and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from either side of said conveyor element and guiding means having straight portions in alignment with the straight portions of the path of movement of said conveyor element and arcuate portions connecting the straight portions but not in alignment with the converging portions of the path of movement of the conveyor element, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element to which the receptacle is attached moves through the converging portions of the path of movement of the conveyor element.

8. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous circuitous path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of the straight portions, a plurality of load receptacles, and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from the said conveyor element and guiding means having straight portions in alignment with the straight portions of the path of movement of said conveyor element but extending beyond the extremities thereof and arcuate portions connecting the straight portions but not in alignment with the converging portions of the path of movement of said conveyor element, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element to which the receptacle is attached moves through the converging portions of the path of movement of the conveyor element.

9. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous convolute path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of successive adjacent straight portions, a plurality of load receptacles, and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from either side of said conveyor element and guiding means having straight portions in alignment with the straight portions of the path of movement of said conveyor element but extending beyond the extremities thereof and arcuate portions connecting the straight portions but not in alignment with the converging portions of the path of movement of said conveyor element, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element to which the receptacle is attached moves through the converging portions of the path of movement of the conveyor element.

10. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous circuitous path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of the straight portions and moving in one radius of travel, a plurality of load receptacles

and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from the said conveyor element and guiding means having straight portions in alignment with the straight portions of the path of movement of said conveyor element and arcuate portions having a radius greater than the radius of movement of the converging portions of the said conveyor element, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of the said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element to which the receptacle is attached moves through the converging portions of the path of movement of the conveyor element, whereby the receptacle moves at a speed greater than the portion of the conveyor element to which it is attached when the latter moves through the converging portions of its path of movement.

11. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous convolute path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of successive adjacent straight portions and moving in one radius of travel, a plurality of load receptacles and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from the said conveyor element and guiding means having straight portions in alignment with the straight portions of the path of movement of said conveyor element and arcuate portions having a radius greater than the radius of movement of the converging portions of the said conveyor element, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of the said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element to which the receptacle is attached moves through the converging portions of the path of movement of the conveyor element, whereby the receptacle moves at a speed greater than the portion of the conveyor element to which it is attached when the latter moves through the converging portions of its path of movement.

12. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous circuitous path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of the straight portions and moving in one radius of travel, a plurality of load receptacles and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from the said conveyor element and guiding means having straight portions in alignment with the straight portions of the path of movement of said conveyor element and arcuate portions having a radius of less than half of the distance between adjacent straight portions of movement of the said conveyor element, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of the said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element to which the receptacle is attached moves through the converging portions of the path of movement of the conveyor element, whereby the sad load receptacles move at a speed greater than the speed of movement of the conveyor element when that portion of the conveyor element to which the receptacles are attached moves through the converging portions of its path of movement.

13. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous convolute path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of successive adjacent straight portions and moving in one radius of travel, a plurality of load receptacles and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith to permit lateral movement of said receptacles to displace them from the said conveyor element and guiding means having straight portions in alignment with the straight portions of the path of movement of said conveyor element and arcuate portions having a radius of less than half of the distance between successive adjacent straight portions of movement of the conveyor element, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of the said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element to which the receptacle is attached moves through the converging por-

tions of the path of movement of the conveyor element, whereby the receptacle moves at a speed greater than the portion of the conveyor element to which it is attached when the latter moves through the converging portions of its path of movement.

14. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous circuitous path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of the straight portions and moving in one radius of travel, a plurality of load receptacles and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith comprising a plate-like member attached to the conveyor element and having a groove therein which a receptacle movably engages thus permitting lateral movement of said receptacles with respect to the said conveyor element and guiding means having straight portions in alignment with the straight portions of the path of movement of said conveyor element and arcuate portions having a radius greater than the radius of movement of the converging portions of the said conveyor element, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of the said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element with which the receptacle is associated moves through the converging portions of the path of movement of the conveyor element, whereby the receptacle moves at a speed greater than the portion of the conveyor element with which it is associated when the latter moves through the converging portions of its path of movement.

15. In a conveyor system, an endless flexible conveyor element, supporting means therefor defining a continuous convolute path of movement for said conveyor element having spaced-apart straight portions and converging portions connecting the ends of successive adjacent straight portions and moving in one radius of travel, a plurality of load receptacles and means for attaching the receptacles in spaced relation to said conveyor element for movement therewith comprising a plate-like member attached to the conveyor element and having a groove therein which a receptacle movably engages thus permitting lateral movement of said receptacles with respect to the said conveyor element on either side thereof and guiding means having straight portions in alignment with the straight portions of the path of movement of said conveyor element and arcuate portions having a radius greater than the radius of movement of the converging portions of the said conveyor element, the straight portions of said guiding means engaging each of said receptacles and defining its path in alignment with the straight portions of the path of movement of said conveyor element and the arcuate portions of said guiding means engaging each of the said receptacles to move it laterally from the endless conveyor element when the portions of the endless conveyor element with which the receptacle is associated moves through the converging portions of the path of movement of the conveyor element, whereby the receptacle moves at a speed greater than the portion of the conveyor element with which it is associated when the latter moves through the converging portions of its path of movement.

16. In an elevator system, the combination with a supporting structure and receptacles moving therein, of a means for loading objects upon said receptacles and unloading objects therefrom, said means comprising a platform on each of said receptacles and means on said platform for moving it in any direction in a plane parallel to the floor of the said receptacle, and means on said platform extendable toward the floor in said supporting structure to constitute inclined ways between the supporting structure and the top surface of the said platform whereby objects may be moved directly upon the said platform from the floor in the supporting structure.

17. In an elevator system, the combination with a supporting structure and receptacles moving therein, of a means for loading objects upon said receptacles and unloading objects therefrom, said means comprising a platform on each of said receptacles and means on each of the said platforms for moving it in any direction in a plane parallel to the floor of said receptacle, and means on each of the said platforms movable to two positions, one in which it engages a floor in said supporting structure, thus constituting inclined ways between the supporting structure and the top surface of each of the said platforms, whereby objects may be moved directly upon the said platforms from the supporting structure, and another in which it projects above the level of the top surface of the platform to constitute a holding means to retain an object on the said platform.

18. In an elevator system, the combination with a supporting structure and receptacles moving therein, of a means for loading objects upon said receptacles and unloading objects therefrom, said means comprising a platform on each of said receptacles and means on each of said platforms for interlocking said platform and its supporting receptacle to prevent relative movement thereof when said means engages the receptacle,

said interlocking means also constituting a pivot about which the platform swings, and means on each of said platforms for moving it in any direction in a plane parallel to the floor of said receptacle.

19. In an elevator system, the combination with a supporting structure and receptacles moving therein, of a means for loading objects on said receptacles and unloading objects therefrom, said means comprising a platform on each of said receptacles and means on each of said platforms for interlocking it and its supporting receptacle to prevent relative movement thereof when said means engages the receptacle, said interlocking means also constituting a pivot about which the platform swings, and means on each of said platforms for moving it in any direction in a plane parallel to the floor of said receptacle, and means on each of said platforms for retaining the object placed thereon in fixed relation thereto, said retaining means comprising a depression in the said platform which engages the object.

20. In an automobile-storage system, a housing structure having at least two spaced openings therein each for entrance and exit of an automobile, an enclosure within said structure between two of said openings and occupying a part of the vertical and horizontal cross-sectional areas of said structure, a plurality of groups of receptacles disposed within the remaining portion of said structure in closely spaced relation whereby such remaining portion is substantially occupied, and means for moving each group of said receptacles through a continuous circuitous convoluted path cooperating with one of said openings.

21. In a conveyor system, a plurality of load receptacles, an endless flexible conveyor element for moving said receptacles, supporting means for defining a continuous circuitous convoluted path of movement including a series of connected convolutions for said conveyor element, and means for causing said receptacles to move at a greater speed than the conveyor element when moving from one of the convolutions of said path to another, said means including means for movably securing said receptacles to said conveyor element to permit lateral linear movement of the receptacles to either side of the conveyor element.

22. In a conveyor system, a plurality of load receptacles disposed in close succession and in a plurality of more than two closely adjacent rows, an endless flexible conveyor element for moving the receptacles successively through the adjacent rows in a continuous circuitous convoluted path, and means for causing said receptacles to move at a greater speed than the conveyor element when they are moving from one of the rows to an adjacent row whereby the spacing between successive receptacles is changed to permit free movement of the receptacles, said means including means for movably attaching said receptacles to said conveyor element to permit a lateral linear movement of the receptacles to either side of said conveyor element.

23. In a conveyor system, a plurality of load receptacles disposed in close succession and in a plurality of closely adjacent rows, means for moving said receptacles successively through the adjacent rows in a continuous circuitous convoluted path, said means including an endless flexible conveyor element, supporting means therefor defining a convoluted path similar to the convoluted path of said receptacles and having a plurality of adjacent straight portions in alignment with the rows of receptacles and converging portion interconnecting the straight portions at their extremities, means for movably attaching said receptacles to said conveyor element to permit lateral linear movement of the receptacles to either side thereof, and means cooperating with the receptacles while said endless element traverses the converging portions of its path of movement for causing said receptacles to move laterally with respect to said conveyor element when they are moving from one row to an adjacent row.

24. In a conveyor system, an endless flexible conveyor element, supporting means for defining a continuous circuitous convoluted path of movement including a series of connected convolutions for said conveyor element, motive means for moving said conveyor element, a plurality of load receptacles disposed in close succession and movable by said conveyor element in a path similar to that of the latter, and means for effecting an increase in the speed of movement of the receptacles without changing the speed of movement of the conveyor element while the receptacles are moving from one of the convolutions of the path to another thereof whereby the necessary clearance between successive receptacles is effected, said means including a supporting member on each receptacle and means attached to said conveyor element for movably securing said supporting member to said conveyor element whereby lateral linear movement of said supporting member to either side of said conveyor element may be effected.

25. In a conveyor system, an endless flexible conveyor element, supporting means for defining a continuous circuitous convoluted path of movement therefor having adjacent straight portions, a plurality of load receptacles disposed in close succession and movable by said conveyor element, means for changing the spacing between successive receptacles when moving from one straight portion to another of the convoluted path

whereby the necessary clearance is obtained, said means including a supporting member on each receptacle and means for movably securing said supporting member to said endless conveyor element whereby the position of the supporting member with respect to said conveyor element may be changed while said receptacles are moving, and means including endless stationary guide means having arcuate portions for changing the position of said supporting member while said receptacles are moving.

26. In a conveyor system, an endless flexible conveyor element, supporting means for defining a continuous circuitous convoluted path of movement therefor having a plurality of more than two adjacent straight portions, a plurality of load receptacles disposed in close succession and movable by said conveyor element, means for changing the spacing between successive receptacles when moving from one straight portion to another of the convoluted path whereby the necessary clearance is obtained, said means including a supporting member on each receptacle and means for movably securing said supporting member to said endless conveyor element whereby the position of the supporting member with respect to said conveyor element may be changed while said receptacles are moving, and stationary guiding means for engaging said supporting member and changing its position while said receptacles are moving.

27. In a conveyor system, an endless flexible conveyor element, supporting means for defining a continuous circuitous convoluted path of movement therefor having a plurality of more than two adjacent straight portions, a plurality of load receptacles movable by said conveyor element and disposed in close succession, means for changing the spacing between successive receptacles when moving from one straight portion to another of the convoluted path whereby the necessary clearance is obtained, said means including a supporting member on each receptacle and means for movably securing said supporting member to said endless conveyor element whereby the said supporting member may be moved to either side of said conveyor element while said receptacles are moving, and means for changing the position of said supporting member while said receptacles are moving.

28. In a conveyor system, an endless flexible conveyor element, supporting means for defining a continuous circuitous convoluted path of movement for said conveyor element, a plurality of load receptacles disposed in close succession and movable by said conveyor element, and means for changing the speed of movement of the receptacles as they transfer from one convolution of the path to another without changing the speed of movement of the conveyor element, said means including a rigid member for each receptacle fixedly attached to said conveyor element and having arms extending on opposite sides of said conveyor element, said rigid member having a groove therein extending by means of said arms to opposite sides of said conveyor element, and a supporting member on each receptacle for engaging the groove in said attached member and movable therein.

29. In a conveyor system, an endles flexible conveyor element, supporting means for defining a continuous circuitous convoluted path of movement for said conveyor element, a plurality of load receptacles disposed in close succession and movable by said conveyor element, and means for changing the speed of movement of the receptacles as they transfer from one convolution of the path to another without changing the speed of movement of the conveyor element, said means including a rigid member for each receptacle fixedly attached to said conveyor element and having arms extending on opposite sides of said conveyor element, said rigid member having a groove therein extending by means of said arms to opposite sides of said conveyor element, a supporting member on each receptacle for engaging the groove in said attached member and movable therein, and means for effecting movement of said supporting member in the groove of said rigid member.

30. In a conveyor system, an endless flexible conveyor element, supporting means for defining a continuous circuitous convoluted path of movement having a plurality of interconnected straight portions for said conveyor element, a plurality of load receptacles disposed in close succession and movable by said conveyor element, and means for changing the spacing between successive receptacles while they are moving from one of the straight portions of the path to another thereof whereby the necessary clearance between them is effected, said means including a supporting member on each receptacle, a rigid member attached to said conveyor element and having a groove therein which extends to opposite sides of said conveyor element, said supporting member engaging the groove in said rigid member and being movable therein laterally to either side of said conveyor element, and guiding means for slidably engaging said supporting member of each receptacle to maintain it in a central position in the groove of the said rigid member when the receptacles are moving through the straight portions of the path and to cause a lateral movement of said supporting member in the groove when the receptacle associated therewith is moving from one of the straight portions of the path to another.

31. In a storage system, a building structure, an enclosure therein occupying a portion of the horizontal and vertical cross-sectional areas enclosed by said structure, a plu-

rality of groups of receptacles, each group comprising a plurality of receptacles disposed in close succession and movable successively through a plurality of adjacent straight paths in a continuous circuitous convoluted path, said plurality of groups of receptacles being contiguous whereby entrance and exit to receptacles of interior groups is effected only through the receptacles of exterior groups aligned therewith.

32. In a storage system, a building structure, means for effecting a maximum efficiency of utilization of the space enclosed by said building structure, said means including a plurality of separately operable endless conveyor elements disposed in contiguous relation throughout the depth of the said structure, each of said conveyor elements comprising a plurality of load receptacles disposed in close succession, endless flexible means for supporting and moving said receptacles through a continuous circuitous convoluted path having closely adjacent straight portions interconnected at the ends thereof, and means for changing the spacing between successive receptacles without detaching them from said endless flexible means whereby the necessary clearance is effected to permit free movement of the receptacles in the path when moving from one straight portion thereof to another, the receptacles of the contiguous conveyor elements being alignable at transfer points between the adjacent straight portions of the paths of movement thereof to effect loading and unloading of the receptacles of interior conveyor elements, otherwise inaccessible, through the receptacles of exterior conveyor elements aligned therewith.

33. In a conveyor system, a pair of endless flexible members disposed in spaced parallel vertical planes, supporting means for defining similar paths of movement for said endless members having a plurality of convolutions therein, motive means for moving said endless members, a plurality of load receptacles disposed in close succession between said endless members and movable thereby through an endless convoluted path of movement substantially similar to that of the endless members, and means for effecting an increase in the spacing between successive receptacles while they are moving from one convolution to another in their path of movement, whereby the necessary clearance therebetween is obtained to permit freedom of movement of the receptacles, said means including a pair of rigid members for each receptacle attached respectively at opposite ends of a receptacle to the endless members and each having a groove therein extending to opposite sides of the endless member to which it is attached, supporting means on opposite ends of a receptacle for engaging the groove in the associated rigid member and movable therein to either side of said endless member, and means for effecting a movement of said supporting means in the grooves while said receptacles are moving.

In testimony whereof, I have hereunto subscribed my name this 4th day of September, 1929.

HENRY D. JAMES.