May 9, 1933. H. D. JAMES 1,907,971

CIRCUITOUS ELEVATOR

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Fig. 1.

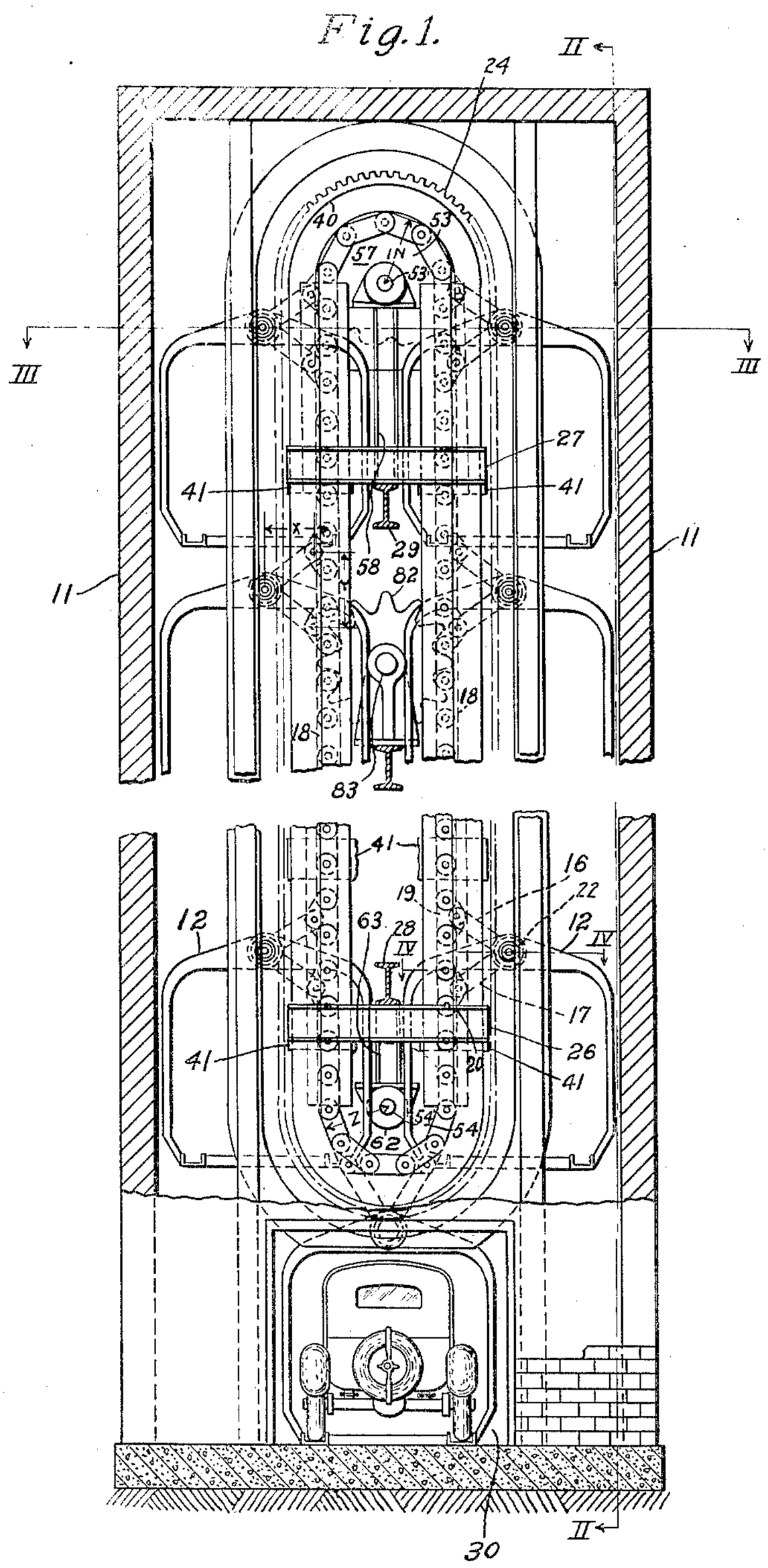

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Fig. 2.

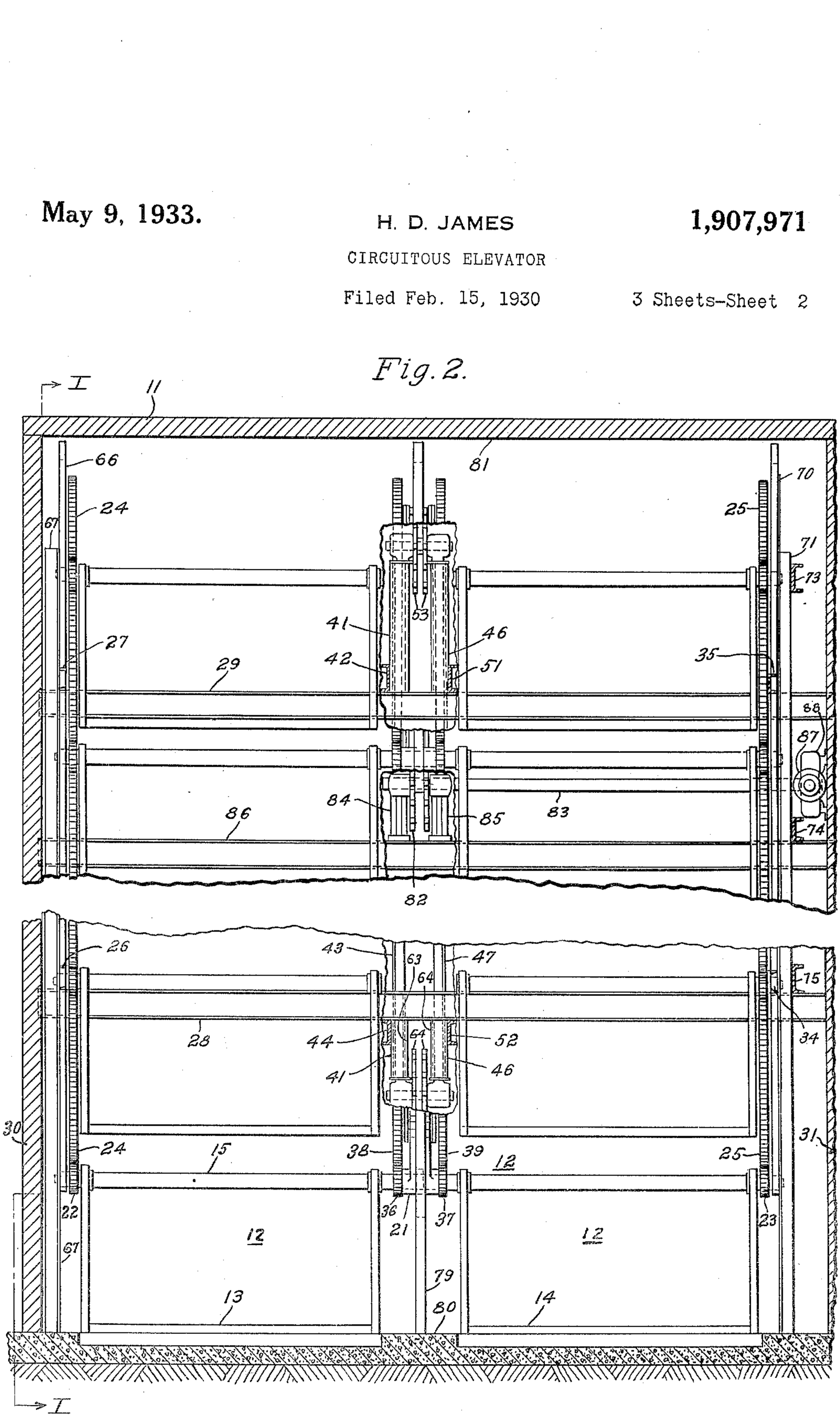

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Fig. 3.

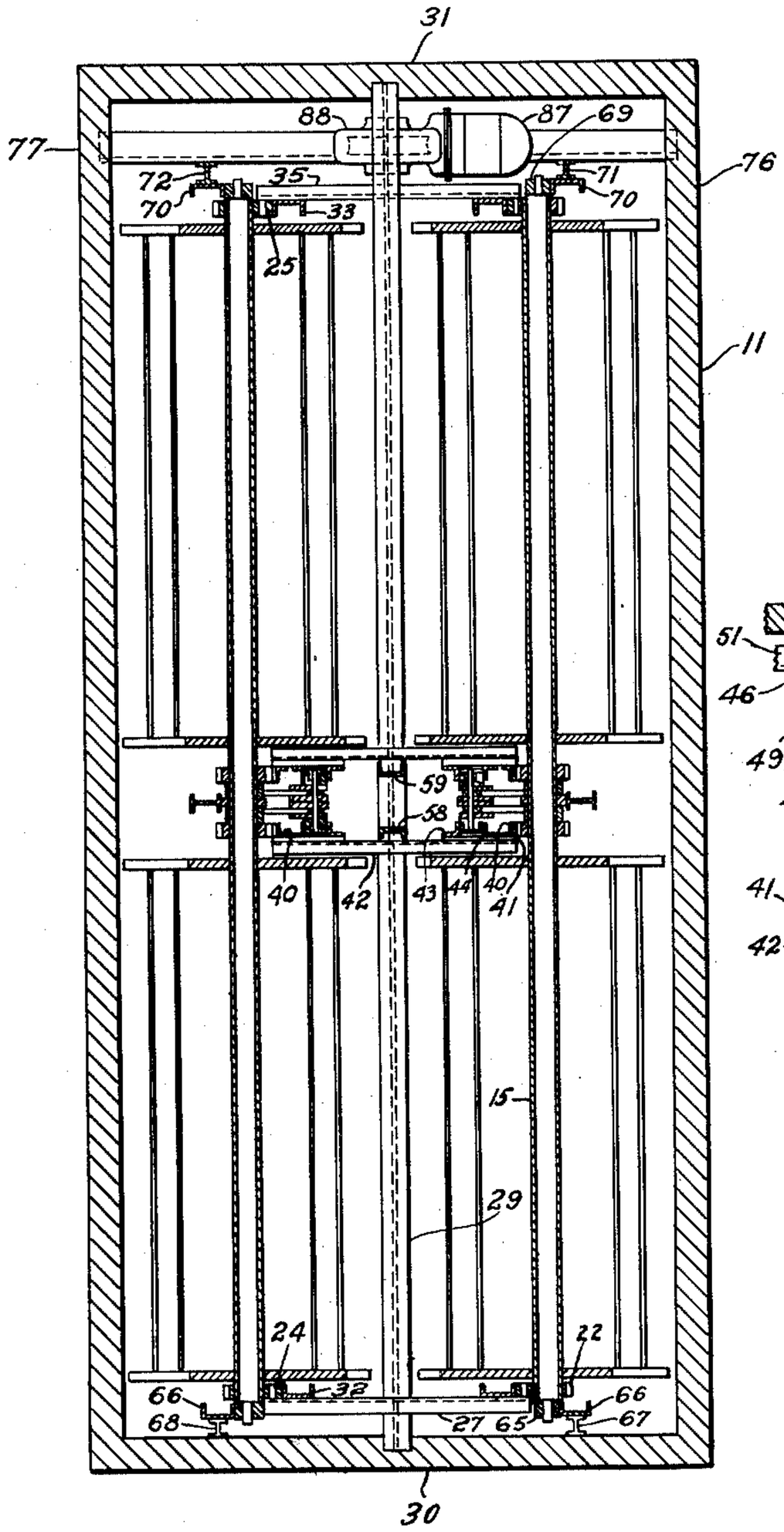
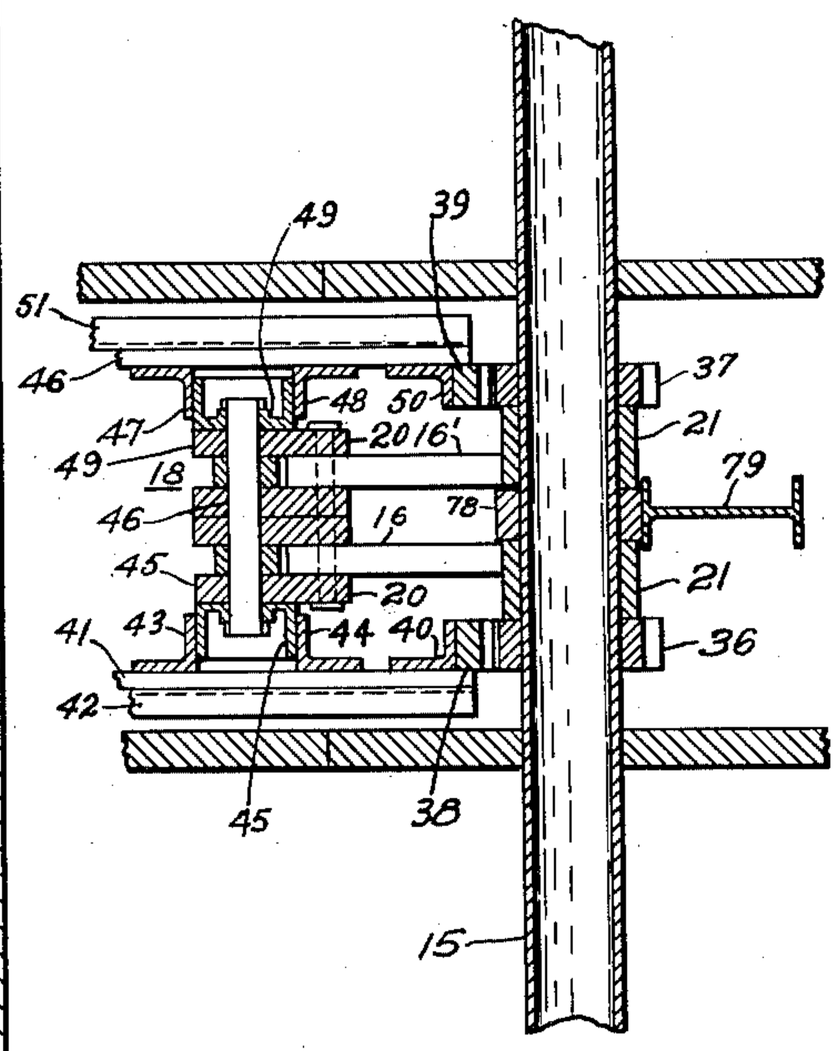


Fig. 4.



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Patented May 9, 1933 1,907,971

UNITED STATES PATENT OFFICE

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CIRCUITOUS ELEVATOR

Application filed February 15, 1930. Serial No. 428,622.

My invention relates to a circuitous elevator for moving and storing objects, and particularly to a circuitous elevator for moving and storing objects which comprises a plurality of load receptacles supported from a single endless flexible member.

The term "circuitous elevator" as used herein designates a type of elevator which comprises a plurality of load receptacles suitably supported in a supporting structure in successive relation to one another and adapted for circuitous movement through a continuous or endless path.

Various types of construction for circuitous elevators have been suggested. One type comprises a plurality of load receptacles supported from a pair of endless flexible members or chains, each having a contour of an elongated loop, which are disposed apart in parallel planes, one end of each load receptacle being attached to one of the endless flexible members, and the other end to the other endless flexible member at a corresponding level to that of the first end.

This type of circuitous elevator has been adapted for storing and parking automobiles. The most practical construction for the endless flexible members in this application thereof has been to use endless chains. It will be understood that the various cooperating links of the endless chains constitute a great number of moving parts which, due to the great stresses, results in excessive friction and wear, and entails a maintenance and repair cost which is objectionable. In order to reduce the number of cooperatively moving parts and thus reduce the cost of maintenance and repair, I have invented a circuitous elevator which comprises but one endless flexible member or chain. The cost of maintenance and repair is thus greatly reduced in the circuitous elevator of my invention.

In perfecting my invention it was necessary to solve the problem of properly and adequately supporting the single endless chain and my invention includes a solution thereto which will be disclosed in the following description of my invention.

It is, therefore, an object of my invention to construct a circuitous elevator having a minimum number of wearing parts, whereby the cost of maintenance and repair is maintained at a minimum.

Another object of my invention is to construct a circuitous elevator having but one endless flexible member or chain for supporting a plurality of load receptacles.

Another object of my invention is to provide a suitable supporting structure for the various elements comprising the circuitous elevator of my invention.

Other objects of my invention will be, in part, obvious and, in part, emphasized in the subsequent description of my invention.

My invention is described with reference to the accompanying figures wherein

Figure 1 is a front elevational view with parts broken away illustrating the structure of the circuitous elevator generally and its application to the moving and storing of automobiles.

Fig. 2 is a sectional view on line II—II of Fig. 1, further illustrating the structural elements comprising the circuitous elevator of my invention.

Fig. 3 is a sectional view on line III—III of Fig. 1, illustrating the structure of the load receptacles and the method of their support to the single endless chain, and

Fig. 4 is an enlarged sectional view on the line IV—IV of Fig. 1, illustrating in detail the method of attachment of the supporting trunnion bar of each load receptacle to the endless chain.

Referring to Figs. 1, 2 and 3, it will be seen that my invention comprises a building structure 11 of a common type of construction which may or may not be totally enclosed as illustrated. Within the building

structure 11 is a plurality of load receptacles 12 disposed in two adjacent columns. As illustrated, these load receptacles are constructed of suitable structural material and are of a size sufficient to hold automobiles, but it should be understood that I do not mean to limit my invention to its application for moving and storing automobiles only and therefore, the size of the receptacles as well as structural material might vary with the particular use to which my invention is applied.

The receptacles are attached in closely spaced relation to a single endless flexible member 18; in the figures shown as a chain. This endless chain 18 is suitably supported within the building structure at the top by the sprocket or sheave wheel 53, and at the bottom by the sprocket or sheave wheel 54. The chain 18 comprises a plurality of link members in parallel and is what is commonly known as a multiple link chain. In order to engage the separate rollers between the parallel link members of the chain 18, the sprocket or sheave wheels 53 and 54 comprise two parallel disc-like members properly spaced apart so as to engage the separate rollers of the chain 18.

The sprocket or sheave wheel 53 is keyed to a shaft 53′ which is rotatably supported in a bearing member 57 which is in turn suitably supported upon a pedestal comprising the vertical channel members 58 and 59. These channel members are suitably attached to and supported upon the I-beam member 29, which extends from the front wall to the rear wall of the building structure 11 and is disposed centrally of the building structure in the space between the two columns of receptacles 12. (See Fig. 1.)

The lower sprocket or sheave wheel 54 is keyed to a shaft 54′ which is rotatably supported in a suitable bearing member 62 which is suspended from an I-beam member 28 similar to the I-beam member 29 by the two channel members 63 and 64.

Each receptacle 12 comprises two separate compartments or slings 13 and 14 each of a box shape. The receptacles 12 are disposed with respect to the endless chain 18 so that the sling 13 is on one side of the plane of the endless chain 18 and the sling 14 is on the opposite side of the plane of the endless chain.

Rotatably attached to both slings 13 and 14 and disposed perpendicularly to the plane of the endless chain 18 is a trunnion bar 15. This trunnion bar may be of solid or pipe construction, the latter being illustrated in Fig. 3.

The slings 13 and 14 of each receptacle 12 are spaced apart a sufficient amount to allow the endless chain 18 and its associated structure to be positioned between them.

A bracket arm means for pivotally attaching the portion of the trunnion rod 15 between the two slings 13 and 14 of each receptacle, to the endless chain 18 is provided and comprises the arms 16 and 16′ aligned with each other in parallel relation and disposed in an angular relation to the arms 17 and 17′ which are aligned in parallel relation with each other. Corresponding ends of the arms 16 and 16′ are pivotally attached to link members 19 of the endless chain 18. Corresponding ends of the arms 17 and 17′ are pivotally attached to another portion of the endless chain 18 at the link members 20 which are some distance from the link members 19. The opposite ends of all the members 16, 16′, 17 and 17′ are suitably attached to a bearing or journal member 21 in which the trunnion bar 15 is rotatably supported at its central portion.

Obviously, my invention is not limited to a bracket member such as shown, since a different number of bracket arm members can be used depending upon the strength required.

The distance between the points of attachment of the bracket arm members 16, 16′ and 17 17′ to the link members 19 and 20, respectively, is shown as being substantially equal to the shortest distance from the bearing or journal member 21 to the endless chain 18. That is, dimension X is substantially equal to the dimension Y shown in Fig. 1. It should be understood that this is a preferred relation but, however, the relation may be changed so that the dimension Y may be greater than the dimension X.

This relation of dimensions is preferred because thereby the forces on the endless chain 18 tending to distort it laterally exerted by the arms 16 and 16′ in one direction and the arms 17 and 17′ in the opposite direction due to the movement effected by the receptacles are maintained within reasonable limits, since with dimension X equal to dimension Y, the lateral thrust forces exerted upon the endless chain 18 at the points of attachment of the bracket arm members 16, 16′, 17 and 17′ are equal to the weight of a receptacle or the weight of a receptacle plus any load disposed therein. Increasing the dimension Y, that is increasing the distance between the points of attachment of the bracket arms to the endless chain, causes this lateral force or thrust tending to distort the endless chain 18 to be even less than the weight of the receptacle or the weight of the receptacle plus its load.

The dimension X is substantially equal to the radius Z of the sprocket or sheave wheels 53 and 54 and, therefore, it will be clear that the speed of movement of the trunnion bars 15 and the receptacles supported therefrom will increase to a value approximately twice that of the endless chain which is the same as the normal speed of movement of the re-

ceptacles through their vertical paths of movement as the receptacles transfer around the sprocket wheels from one vertical path of movement to the other. The change in speed is gradual, the receptacles accelerating gradually to a maximum speed approximately twice that of the endless chain 18 and then gradually decelerating to the normal speed of movement of the receptacles in the vertical paths.

The reason for attaching the receptacles to the endless chain 18 by the bracket arm members 16, 16′, 17 and 17′ or a bracket arm member similar thereto will be obvious, namely, that such a method of support in which the receptacles are laterally displaced from the line of movement of the endless chain enables the receptacles to move through the vertical paths, in closely spaced relation, at a certain speed and be transferred from one vertical path to the other at a greater speed thus effecting proper clearance of successive receptacles as they transfer around the sheave wheels 53 and 54.

Although the point of support for each receptacle 12 is located centrally and preferably directly above its center of gravity so that the receptacles will naturally maintain a substantially horizontal position, it will be obvious that additional supporting means for each end of the receptacles is necessary when the receptacles are unsymmetrically loaded, as, for example, when one of the slings 13 or a receptacle 12 is loaded and the other sling 14 is not loaded. Therefore, in order to provide a suitable support in cases of this kind, I have provided at one end of the trunnion bar 15 on each receptacle, a pinion gear 22 which is keyed thereto and at the other end a pinion gear 23 which is likewise keyed thereto. Disposed in properly associative relation with each of the pinion gears 22 and 23, respectively, are endless rack members 24 and 25 which have a contour similar to that of the endless flexible member or chain 18. These rack members 24 and 25 are suitably attached, as shown in Fig. 3, to supporting channel members 32 and 33 respectively, which have a similar contour to their own. The channel member 32 supporting the rack member 24 is in turn attached to or supported from the building structure 11 by horizontally disposed channel members 26 and 27 which are supported by I-beam members 28 and 29, respectively. The channel member 33 supporting the rack member 25 is attached to or supported from the building structure by the horizontally disposed channel members 34 and 35 which are in turn supported, respectively, upon the I-beams members 28 and 29, as shown in Fig. 2.

For the sake of simplicity, I have shown only two attaching members for each of the rack members 24 and 25, one at the top of the building structure and the other at the bottom. Obviously, other similar supporting structures may be added between the top and bottom supporting members and varying in number with the height of the building structure 11 to secure proper rigidity of the rack members 24 and 25.

Keyed to each trunnion bar 15 at its central portion are located two pinion gears 36 and 37, one immediately adjacent one side of the bearing or journal 21 and the other immediately adjacent the opposite side thereof, as shown in Fig. 4. The pinion 36 engages an endless rack member 38 and the pinion 37 engages an endless rack member 39 both similar to the rack members 24 and 25.

The rack member 38 is attached to a supporting angle bar member 40 which is of substantially similar contour to its own. Referring to Figs. 1 and 4, it will be seen that to the angle bar member 40 are suitably attached, as by welding, a series of plate members 41 spaced at intervals around its contour. Suitably attached to plate members 41 at the top of the two straight portions of the rack member 38, as by welding, is a horizontally disposed channel member 42. More particularly, one end of the channel member 42 is attached to a plate member 41 attached to one straight portion of the rack member 38 and the other end suitably attached to the plate member 41 attached to the top of the other straight portion of the rack member 38. The channel member 42 is, in turn, suitably attached or supported on the I-beam member 29. At the bottom of the building structure the channel member 44 is similarly attached to plate members 41 and, in turn, supported by the I-beam member 28.

The endless rack member 39 is similarly attached to an angle bar member 50 similar in contour to its own and to which is attached at spaced intervals throughout its contour plate members 46, similar to plate members 41. The plate members 46 at the top of the two straight portions of the angle bar member 50 are attached to opposite ends of the channel member 51 which is, in turn, supported by the I-beam member 29. The plate members 46 at the bottom of the straight portions of the angle bar member 50 are attached to opposite ends of the channel member 52 which is, in turn, supported by the I-beam member 28.

In order to maintain a fixed engagement of the pinion gear 22 and the rack member 24, a roller 65 is provided which is rotatably attached to the end of the trunnion bar 15 at which the pinion gear 22 is keyed. This roller engages an endless guide channel member 66 which has a contour corresponding to the path of movement of the load receptacles. The channel member 66 is suitably supported from the building structure or the bottom foundation as by the vertical I-beam

members 67 and 68, respectively, attached to the straight portions thereof.

In order to retain the pinion gear 23 in fixed engagement with its associated rack member 25, a roller 69 is provided which is rotatably attached to the end of the trunnion bar 15 at which the pinion gear 23 is keyed. This roller engages an endless channel member 70 which has a contour corresponding to the path of movement of the load receptacles and which is attached to the building structure by the I-beam members 71 and 72, respectively associated with the straight portions of its contour and, in turn attached to the horizontally disposed channel members 73, 74 and 75 which extend laterally from one side of the building structure 11 to the other and parallel to the front and rear walls thereof.

In order to retain pinion gears 36 and 37 in fixed engagement with the rack members 38 and 39, with which they are respectively associated, a roller 78 is provided which is rotatably attached to the periphery of the bearing or journal member 21 and which engages the endless I-beam member 79 which has a contour similar to the contour of the endless flexible member or chain 18 and is suitably supported from or attached to the foundation 80 and the roof 81 of the building structure 11.

In order to maintain a fixed path of movement for the straight portions of the endless chain 18 and in order to prevent lateral displacement or distortion of the endless chain 18 due to the bending moment exerted by the bracket arms supporting the receptacles, angle bar guide members 43, 44, 47 and 48, are provided, as shown in Fig. 4.

It will be seen that to the plate members 41 disposed on the one side of the endless chain 18 are suitably attached the angle bar members 43 and 44 so disposed that rollers 45 rotatably attached to the pins 46 of the endless chain 18 are retained between the flanged sides thereof. On the opposite side of the endless chain 18, to the plate members 46 are attached the angle bar members 47 and 48 which constitute a guide for the rollers 49 rotatably attached to the opposite ends of the pins 46, of the chain 18. Similar guides are provided for the two straight portions of the path of movement of the endless chain 18.

It will thus be seen that the endless chain will be maintained in a fixed path of travel without any distortion thereof, regardless of the load on the receptacles.

The endless chain is driven circuitously through the path defined by this supporting structure by a sprocket wheel 82 similar to the sprocket or sheave wheels 53 and 54 in that it comprises two parallel disc-like members for engaging separate rollers of the multiple link chain 18 and which is keyed to a shaft 83 which is, in turn, rotatably supported in the bearing members 84 and 85 supported on the I-beam member 86 which extends from the front wall to the rear wall of the building structure and is disposed centrally thereof in the space between the two columns of load receptacles and between the upper and lower sprocket or sheave wheels 53 and 54. A driving motor 87 and an associated gear reduction mechanism 88 are provided to drive the shaft 83 and the sprocket wheel 82.

The driving motor 87 is provided with a suitable control system (not shown) and it may be either of an electrical or a mechanical character depending upon the nature of the driving motor 87.

The operation of my invention should now be easily comprehended from the foregoing description. Let us assume that it is desired to load an object, as for example, an automobile, upon one of the receptacles. In order to load any of the receptacles, the circuitous elevator system is positioned so that the receptacle to be loaded is in the bottommost position of its travel. In this position the floor of the load receptacle is on a level with the bottom floor of the building structure. In Fig. 1 an automobile is driven through the entrance 30, directly through the end of the receptacle into the sling comprising one of the compartments of the receptacle on that side of the endless chain 18. The second compartment or sling of the same receptacle is loaded from the opposite side of the building structure and, in the case of an automobile, it is driven directly upon the sling of the receptacle on the opposite side of the endless chain to that of the sling first mentioned through a suitable doorway 31 provided at that level.

However, it is not necessary that both compartments or slings 13 and 14 of the same receptacle be loaded or occupied since the rack and pinion mechanism supporting opposite ends of each receptacle maintain the receptacle in a substantially normal or horizontal position, regardless of the symmetry of loading of the receptacles.

In applications of my invention to the storage of automobiles both compartments of a receptacle would logically and efficiently be loaded before the receptacle itself would be moved from the loading level and another empty receptacle brought to the loading level. Assuming that it is desired to bring another receptacle to the entrance level at the bottom of the building structure, the operator then, by properly actuating the control mechanism for the driving motor 87, causes the entire circuitous elevator system to be rotated either in one direction or the other to bring a selected receptacle to the entrance level.

As the endless flexible chain 18 moves in either direction, the trunnion bar 15 of each receptacle is caused to rotate in the bearing or journal member 21. The pinion gears 22, 23,

36 and 37 are synchronously rotated therewith and thus all points of the trunnion bar 15 are maintained at the same level which, of course, means that the load receptacle 12 supported therefrom is likewise maintained at a constant horizontal level.

It will thus be seen that my invention comprises a circuitous elevator for moving and storing objects which comprises but one endless flexible member or chain having a plurality of load receptacles suspended therefrom and circuitously movable therewith within a suitable building structure.

It will be understood that the figures used are intended to be illustrative only and my invention is not meant to be limited to the exact structure as shown, since other structures may be used or devised which do not depart from the spirit of my invention.

I claim as my invention:

1. In a circuitous elevator, a supporting structure, a single movable endless flexible member having two adjacent straight portions, means for movably supporting said endless flexible member within said supporting structure and defining its path therein, a plurality of load receptacles attached to said endless flexible member and movable therewith circuitously within the said supporting structure, a pair of relatively movable bracket arms for each receptacle for pivotally attaching it to and in a position at a lateral distance from the endless flexible member and in close relation to adjacent others of said load receptacles during the movement of the receptacles through the straight portions of their path of travel and for effecting a gradual increase in the speed of movement of the receptacles as they transfer from one straight path to the other whereby successive receptacles clear each other, and means for moving said flexible member and the receptacles supported therefrom circuitously within the said supporting structure.

2. In a circuitous elevator, a supporting structure, a single movable endless flexible member, means for supporting said endless flexible member within said supporting structure and defining its path of movement therein, a plurality of load receptacles, a pair of relatively movable bracket arms for each of said receptacles for pivotally attaching it in spaced relation with respect to the others of said receptacles at a point thereon directly above the center of gravity to the endless flexible member in a position at a lateral distance therefrom, and means for moving said endless flexible member circuitously within the said supporting structure.

3. In a circuitous elevator, a supporting structure, a single movable endless flexible member having two adjacent straight portions, means for movably supporting said endless flexible member within said supporting structure and defining its path of movement therein, a plurality of load receptacles attached to said endless flexible member and movable therewith circuitously within the said supporting structure, bracket arm means for each receptacle for pivotally attaching it to and in a position at a lateral distance from the endless flexible member and in close relation to adjacent others of said load receptacles during the movement of the receptacles through the straight portions of their path of travel and for effecting an increased speed of movement of the receptacles as they transfer from one straight path to the other whereby successive receptacles clear each other, said bracket arm means comprising two members angularly disposed with respect to each other and having the one end of the one member attached to the endless flexible member at one point thereon and the corresponding end of the other member attached to the endless flexible member at another point thereon, the other corresponding ends of the two members being jointed to constitute a member for pivotally supporting a receptacle, the distance between the points of attachment of the two members comprising one bracket arm to the endless flexible member being at least equal to the shortest distance from the jointure of the two members constituting a member for pivotally supporting a receptacle to the endless flexible member, and means for moving said flexible member and the receptacles supported therefrom circuitously within the said supporting structure.

4. In a circuitous elevator, a supporting structure, a single movable endless flexible member, means for supporting said endless flexible member within said supporting structure and defining its path of movement therein, a plurality of load receptacles disposed in two adjacent columns within the said supporting structure, adjacent receptacles in each column being closely spaced one above the other, trunnion rods on each of said load receptacles, each of the said load receptacles having two compartments which are disposed slightly apart one on one side of the plane of the endless flexible member and the other on the opposite side of the plane of the endless flexible member, bracket arm means attaching the portion of the trunnion rod on each receptacle between the two compartments of that receptacle to the endless flexible member and disposing the receptacle in a position laterally displaced from the path of movement of the endless flexible member, and means for moving the said endless flexible member and the receptacles supported therefrom circuitously within the said supporting structure.

5. In a circuitous elevator, a supporting structure, a single movable endless flexible member, means for supporting said endless flexible member within said supporting

structure and defining its path of movement therein, a plurality of load receptacles disposed in two adjacent columns within said supporting structure, a trunnion rod rotatably attached to each of said load receptacles and disposed in a direction perpendicular to the plane of the endless flexible member, means for rotatably attaching the trunnion rod on each receptacle to the endless flexible member whereby the said load receptacles are supported from the endless flexible member in closely spaced relation to one another, a gear wheel attached to the one end of the trunnion rod and a gear wheel attached to the other end of the same trunnion rod, a rack member having a contour similar to the path of movement of the endless flexible member and disposed apart from the plane of the endless flexible member on one side thereof and a rack member similar to the first mentioned rack member disposed apart from the plane of the endless flexible member and on the opposite side to that on which the first rack member is disposed, means for supporting said rack members within the said building structure, the rack members being engageable by the said gear wheels respectively, the gear wheels on the trunnion rods being synchronously rotatable upon movement of the endless flexible member whereby an equal support is effected for opposite ends of the said load receptacles and a substantially horizontal position of the receptacles is maintained regardless of the disposition of the load placed therein, and means for moving the endless flexible member and the receptacles supported therefrom circuitously within the supporting structure.

6. In a circuitous elevator, a supporting structure, a single movable endless flexible member, means for supporting said endless flexible member within said supporting structure and defining its path of movement therein, a plurality of load receptacles disposed in two adjacent columns within said supporting structure, a trunnion rod rotatably attached to each of the receptacles and disposed perpendicular to the plane of the endless flexible member, means for rotatably attaching the trunnion rod to the endless flexible member whereby the said load receptacles are supported from the endless flexible member in closely spaced relation to one another, a gear wheel fixedly attached to one end of the trunnion rod and a gear wheel fixedly attached to the other end of the same trunnion rod, a rack member having a contour similar to the path of movement of the endless flexible member and disposed apart from and parallel to the plane of the endless flexible member on one side thereof and a rack member similar to the first mentioned rack member disposed apart from and parallel to the plane of the endless flexible member on the opposite side to that on which the first rack member is disposed, means for supporting said rack members within the said building structure, the said rack members being engageable by the said gear wheels on the trunnion rods, the said gear wheels on a trunnion rod being synchronously rotatable upon movement of the endless flexible member whereby an equal support is effected for opposite ends of each of the said load receptacles and a substantially horizontal position thereof is maintained regardless of the disposition of the load placed therein, a separate roller rotatably attached to one end of each of the trunnion rods and a separate roller rotatably attached to the opposite end of each of the trunnion rods, a guide engageable by the roller on one end of the trunnion rod and a similar guide engageable by the roller on the other end of the trunnion rod, the said guides having a contour similar to the path of travel of the endless flexible member and retaining the said gear wheels, attached to their respective ends of the trunnion rod, in engagement with the said rack members which they respectively engage, and means for moving the endless flexible member and the receptacles supported therefrom circuitously within the said supporting structure.

7. In a circuitous elevator, a supporting structure, a single endless flexible member movable circuitously in said supporting structure successively through two adjacent straight paths in the same plane, a plurality of load receptacles attached to said endless flexible member and disposed in two adjacent oppositely movable rows having a space therebetween, means at the top of the supporting structure defining the path of and supporting the endless flexible member thereat, said means including a supporting member of said supporting structure disposed perpendicularly to the plane of the endless flexible member in the space between the adjacent rows of receptacles, and means at the bottom of the supporting structure defining the path of and supporting the endless flexible member thereat, said last means including a supporting member of said supporting structure disposed perpendicular to the plane of the endless flexible member in the space between the adjacent rows of receptacles.

8. In combination, a single movable endless flexible member, means for supporting and moving said endless member in an endless path having straight and curved portions, a plurality of load receptacles disposed to be moved by said endless member in a path similar to its own, and means for attaching said receptacles to said endless member in spaced relation, including a pair of relatively movable arms for movably connecting each receptacle to the endless flexible member and effecting gradual changes in the speed of movement of said receptacles as they traverse the curved portions of their path of travel.

9. In combination, a single movable endless flexible member, means for supporting and moving said endless member in an endless path having straight and curved portions, a plurality of load receptacles disposed to be moved by said endless member in a path similar to its own, and means for connecting said receptacles to said endless member in closely spaced relation and effecting a speed of movement of said receptacles which is greater than that of the endless member when the receptacles traverse a curved portion of their path of movement whereby proper clearance between successive receptacles is obtained, said last mentioned means including a pair of relatively movable arms for connecting each receptacle to said endless flexible member and effecting gradual increases and decreases in the speed of movement of said receptacles as they traverse the curved portions of their path of travel.

10. In combination, a single movable endless flexible member, means for supporting and moving said endless member in an endless path having straight and curved portions, a plurality of load receptacles disposed to be moved by said endless member in a path similar to its own, and a pair of relatively movable arms for each receptacle for attaching it to said endless member in a position wherein portions thereof project on opposite sides of the plane of said endless member, said arms being relatively movable to effect gradual changes in the speed of movement of the receptacles as they traverse curved portions of their path of travel.

11. In combination, a single movable endless flexible member, means for supporting and moving said endless member in an endless path having straight and curved portions, a plurality of load receptacles disposed to be moved by said endless member in a path similar to its own, and a pair of relatively movable arms for each receptacle for attaching the receptacles to said endless member in closely spaced relation and in positions wherein portions thereof project on opposite sides of the plane of said endless member, said arms effecting a change in the speed of movement of said receptacles as they traverse the curved portions of their path of travel whereby proper clearance between successive receptacles is obtained, and being relatively movable to effect such changes in speed gradually.

12. In combination, a single movable endless flexible member, means for supporting and moving said endless member in an endless path, a plurality of load receptacles pivotaliy attached to said endless member in positions wherein portions of said receptacles project on opposite sides of the plane of said endless member, and means for continuously supporting one end of each of the receptacles on one side of the plane of said endless member for maintaining the receptacles in horizontal position regardless of the manner of imposition of load therein, including a stationary endless rack, a shaft mounted on each receptacle, and a gear wheel on each of said shafts for engaging said stationary rack and rotating in accordance with the movement of the receptacles.

13. In combination, a single movable endless flexible member, means for supporting and moving said endless member in an endless path, a plurality of load receptacles pivotally attached to said endless member in positions wherein portions of said receptacles project on opposite sides of the plane of said endless member, and means for continuously supporting the opposite ends of said receptacles on opposite sides of the plane of the endless member for maintaining the receptacles each in a horizontal position regardless of the manner of imposition of load therein, including a pair of spaced endless racks disposed in parallel relation to the plane of said endless member and at opposite ends, respectively, of said receptacles, a shaft mounted on each receptacle, and a gear wheel on the opposite ends of each of said shafts for engaging the endless rack at that end and rotating in accordance with the movement of the receptacles.

14. In combination, a single movable endless flexible member, means for supporting and moving said endless member in an endless path, a plurality of load receptacles pivotally attached to said endless member in positions wherein portions of said receptacles project on opposite sides of the plane of said endless member, and means for continuously supporting one end of each of the receptacles on one side of the plane of said endless member for maintaining the receptacle in a horizontal position regardless of the manner of imposition of load therein, including a stationary endless rack, a shaft for each receptacle rotatably mounted thereon, and a gear wheel secured to each of said shafts for engaging said stationary rack, said gear wheels and shafts being rotatable in accordance with the movement of the receptacles by the cooperation of the gear wheels with the stationary rack during the movement of the receptacles.

15. In combination, a single movable endless flexible member, means for supporting and moving said endless member in an endless path, a plurality of load receptacles pivotally attached to said endless member in positions wherein portions of said receptacles project on opposite sides of the plane of said endless member, and means for continuously supporting the opposite ends of said receptacles on opposite sides of the plane of the endless member for maintaining the receptacles each in a horizontal position regardless of the manner of imposition of load

therein, including a pair of spaced endless racks disposed in parallel relation to the plane of said endless member and at opposite ends, respectively, of said receptacles, a shaft rotatably mounted on each receptacle, and a gear wheel on opposite ends of each of said shafts for engaging the endless rack at that end, said gear wheels and their shafts being simultaneously rotatable at the same speed in accordance with the speed of movement of the receptacles by the cooperation of the gear wheels with their racks during the movement of the receptacles.

In testimony whereof, I have hereunto subscribed my name this 5th day of February 1930.

HENRY D. JAMES.