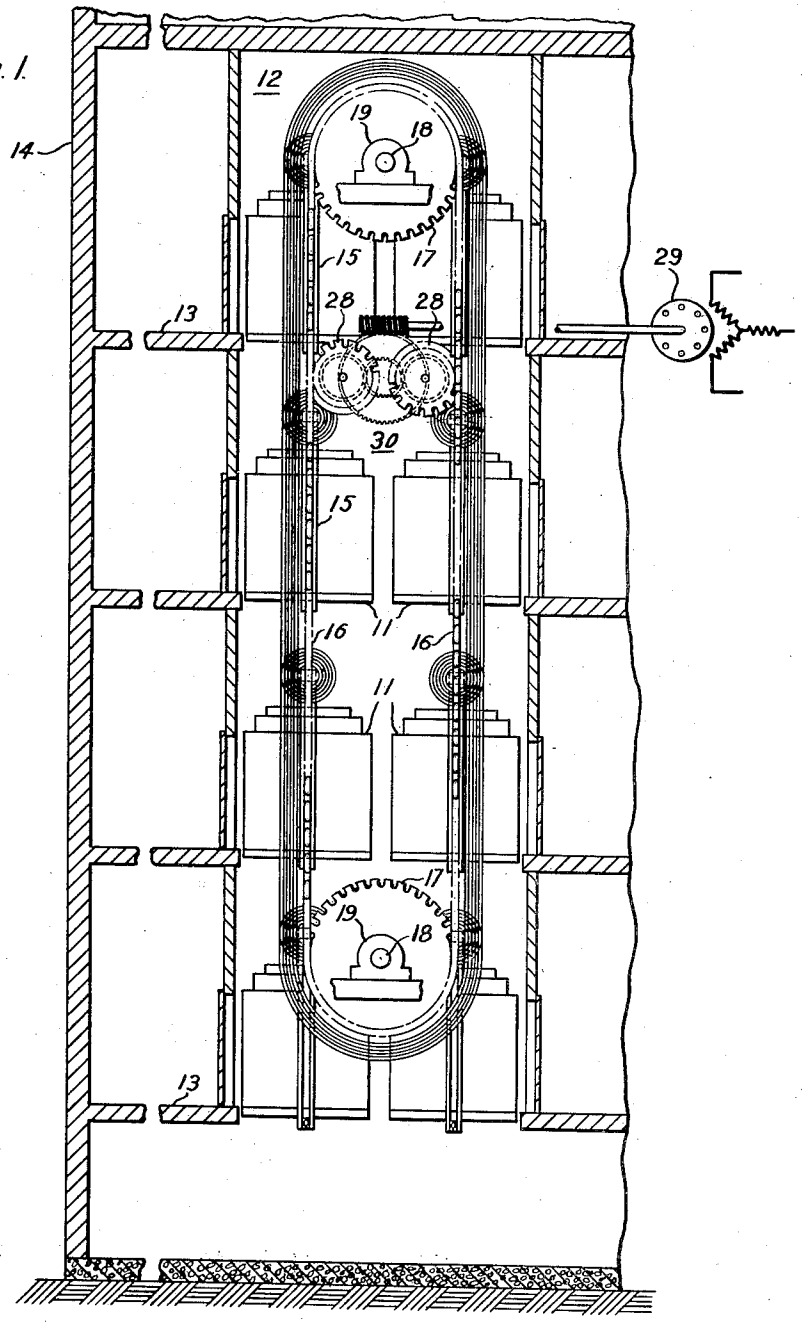
Aug. 21, 1934. H. D. JAMES ET AL 1,971,072

CIRCUITOUS ELEVATOR

Filed May 6, 1931 4 Sheets-Sheet 1

Fig. 1.



WITNESSES:

Arthur C. McMahon

A. A. Steinmiller

INVENTORS.

Henry D. James &

Harold E. White.

BY

Wesley G. Carr

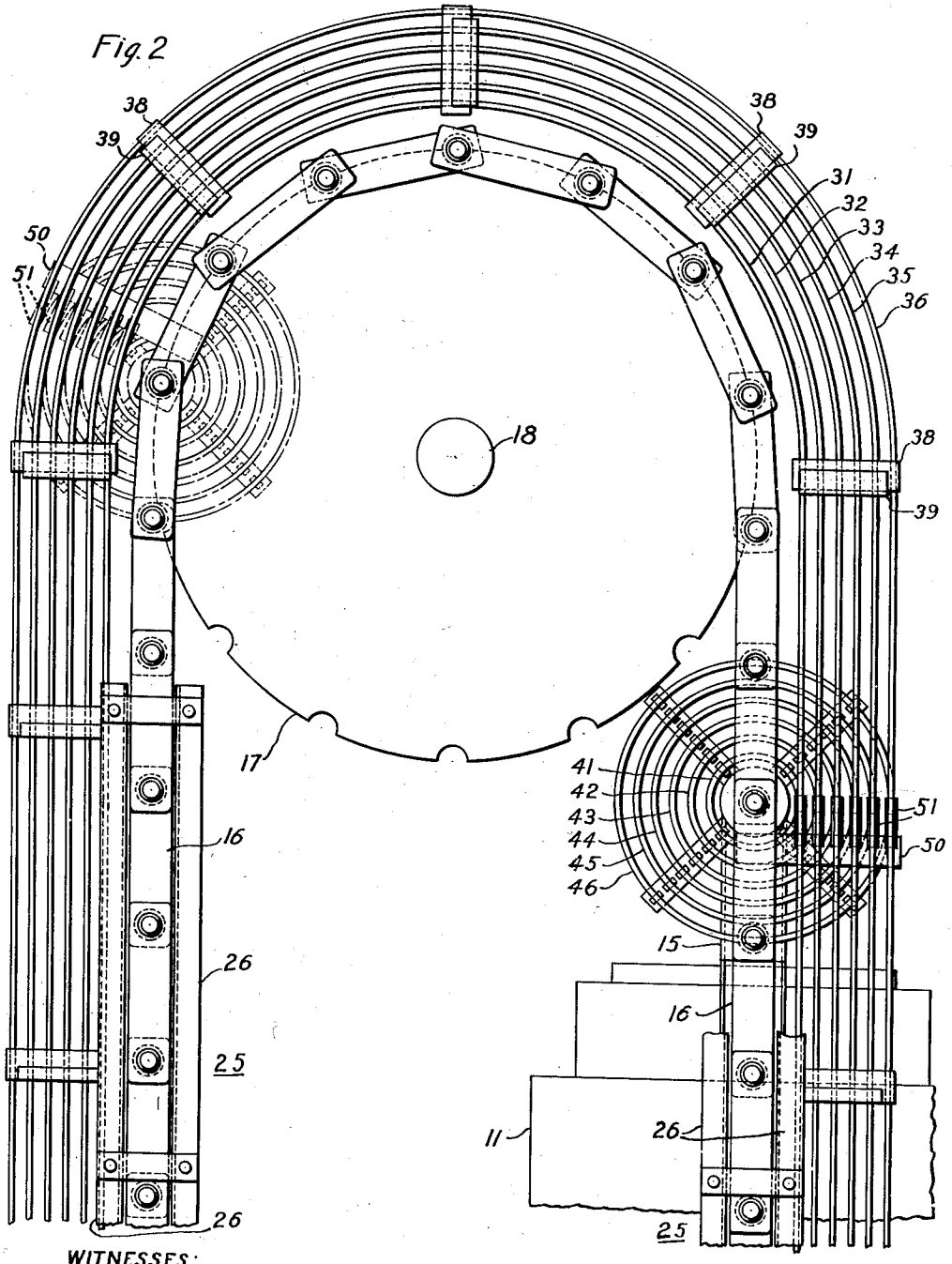
ATTORNEY

Aug. 21, 1934. H. D. JAMES ET AL 1,971,072

CIRCUITOUS ELEVATOR

Filed May 6, 1931 4 Sheets-Sheet 2

Fig. 2



WITNESSES:

Arthur J. McMahon

A. A. Steinmiller

INVENTORS.

Henry D. James &

Harold E. White.

BY

Wesley G. Carr

ATTORNEY

Aug. 21, 1934. H. D. JAMES ET AL 1,971,072

CIRCUITOUS ELEVATOR

Filed May 6, 1931 4 Sheets-Sheet 3

Fig. 3.

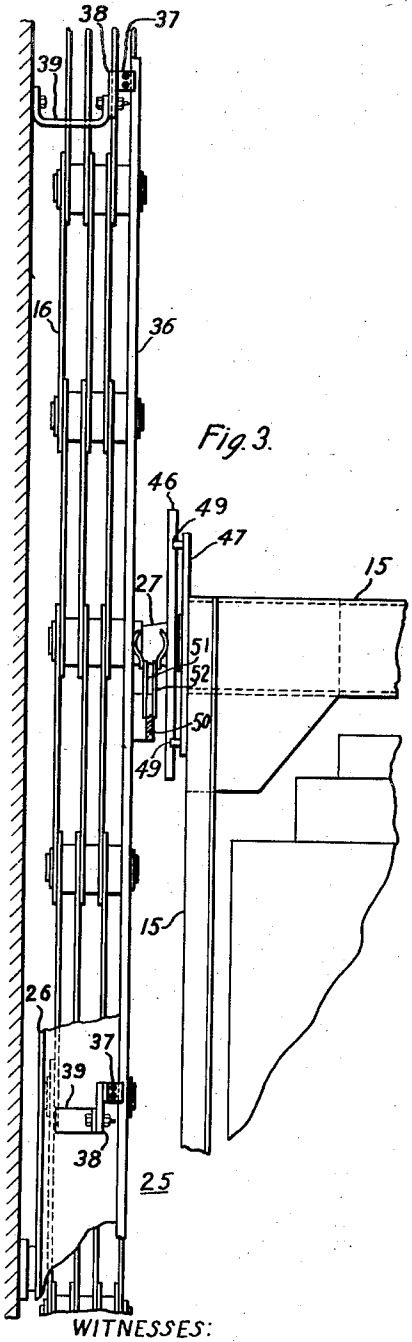


Fig. 5.

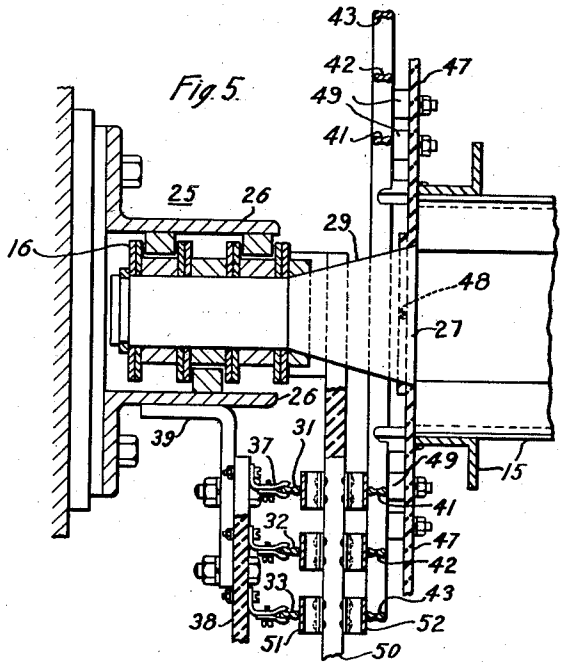
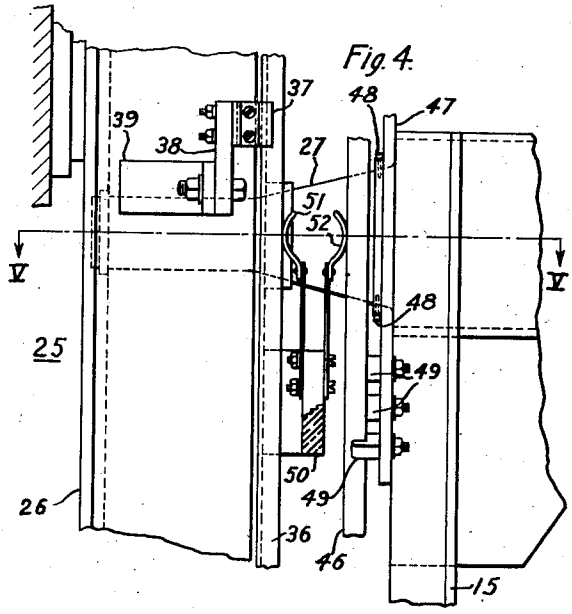


Fig. 4.



WITNESSES:

Arthur J. McMahon

A. A. Steinmiller

INVENTORS.

Henry D. James &

Harold E. White.

BY

Wesley G. Carr

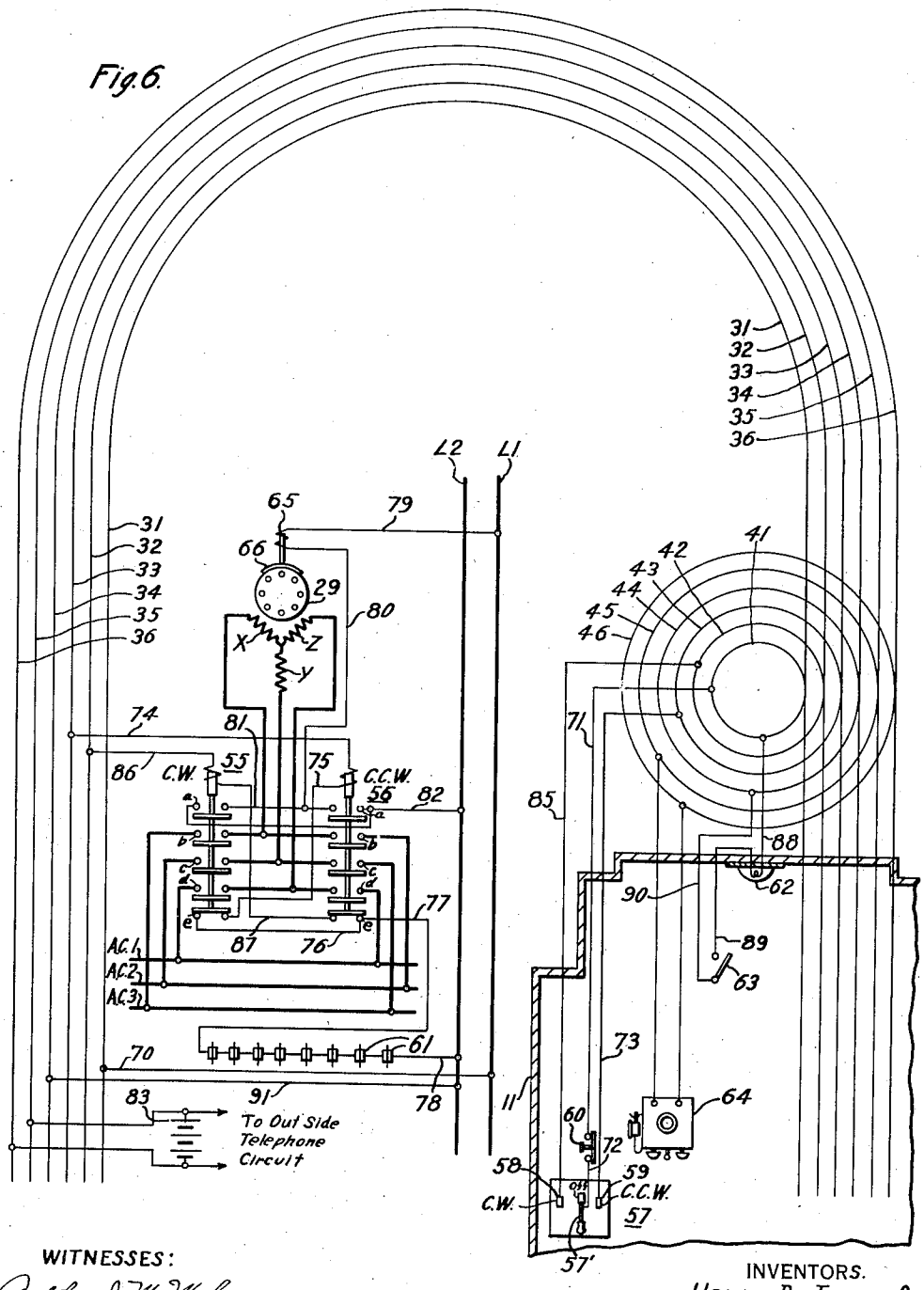
ATTORNEY

Aug. 21, 1934. H. D. JAMES ET AL 1,971,072

CIRCUITOUS ELEVATOR

Filed May 6, 1931 4 Sheets-Sheet 4

Fig. 6.



WITNESSES:

Arthur J. McMahon

A. A. Steinmiller

INVENTORS.

Henry D. James &

Harold E. White.

BY

Wesley G. Carr

ATTORNEY

Patented Aug. 21, 1934 1,971,072

UNITED STATES PATENT OFFICE

1,971,072

CIRCUITOUS ELEVATOR

Henry D. James, Edgewood, and Harold E. White, Wilkinsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company, a corporation of Pennsylvania

Application May 6, 1931, Serial No. 535,454

12 Claims. (Cl. 187—16)

Our invention relates to circuitous elevators, especially circuitous elevators employed in department stores, hotels, office buildings and the like for passenger service, and it has particular relation to control system for such elevators, including means on one or more of the elevator cars for reversibly controlling the movement of the elevator and including means for effecting a multi-circuit electrical connection to all of the elevator cars from stationary external points.

The term "circuitous elevator", as employed herein, designates a structure of any type having one or more receptacles, cages or cars movable in a circuitous or endless path.

A circuitous elevator, employed particularly for passenger service, and a control system for effecting the operation of the elevators from a point or points outside of the elevator cars or cages, is disclosed in the copending application of Henry D. James, Serial No. 414,683, filed December 17, 1929, and assigned to the Westinghouse Electric & Manufacturing Company.

Our present invention is an improvement upon the elevator disclosed in the above-mentioned copending application and, in addition to the structure and control described therein, comprises a means for effecting the control of a circuitous-elevator driving-motor by control devices on one or more cars and includes a means for continuously establishing a multi-circuit electrical connection to all the cars, whereby such control may be effected. Our invention further comprehends the employment of the means for effecting the electrical connection to the cars as a means for effecting the illumination of the cars from a stationary external source of energy, as well as for effecting the connection of signal devices, such as telephones, on the cars, to similar devices on other cars or at stationary external points.

In our copending application, Serial No. 486,690, filed October 6, 1930, assigned to the Westinghouse Electric & Manufacturing Company, we have described and claimed a novel control system for a circuitous elevator in which an electrical connection is capable of being established to all of the cars or cages, but the electrical connection is limited to a single conducting path and employs the metallic structure of the elevator as a part of the return circuit. That is, in our prior invention, only one conducting path was established to the cars but not a circuit comprising a forward conductor and a return conductor. The structure which embodies our present invention possesses an advantage over the structure described in the copending application, just mentioned, in that our present structure enables one or more circuits to be continuously maintained to each of the cars without employing the metallic structure of the elevator as the part of the electrical circuit and whereby substantially constant-resistance electrical paths are obtained which are completely insulated from the metallic part of the elevator structure.

We have described and claimed, in our previously-mentioned copending application, a control lever on each of the cars for controlling the single electrical connection established to each of them, whereby a limited control over the movement of the circuitous elevator may be effected. For example, when a car is positioned in any position other than a predetermined one, and the control lever thereon is operated, the actuation of the motor for driving the circuitous elevator is automatically effected, whereby the car, on which the control lever is disposed, is moved to the predetermined position by the shortest route and is automatically stopped thereat upon its arrival. In other words, in our prior invention, an unlimited control over the operation of the elevator driving motor may not be effected by the control lever on the elevator cars.

In our present invention, the structure which we have devised for establishing a multi-circuit connection to each of the elevator cars is inherently capable of being employed for the purpose of providing a control means on each of them which permits full control over the operation of the elevator driving motor. In other words, we have provided a control means on each of the cars, in our present invention, which permits the circuitous elevator to be moved optionally in either direction and to any extent, even to that of the cars repeatedly traversing their circuitous path without stopping.

Obviously, an elevator employed for passenger service must necessarily have some source of illumination in the cars, because, otherwise, they would normally travel a dark hatchway. Premising that, for commercial operation of circuitous passenger elevators, it is necessary to provide illumination for the cars, it must follow that, in order to satisfactorily supply energy to the illuminating means in the cars, there must be provided a stationary source of energy external to the moving system of elevator cars, such as a motor-driven generator, and some means for effecting a continuous connection be-

tween the movable cars and the stationary source.

It is desirable for signalling or testing purposes, or necessary, as in cases where the circuitous elevator system is stopped with all of the cages between their regular stopping stations, to provide communication between one or more of the elevator cars of a circuitous elevator and an external point, such as the office of a superintendent of operations or service man.

As an illustration, therefore, we have provided a telephone instrument in one or more of the elevator cars, and we employ, to good advantage, the device comprising our present invention for continuously maintaining the connection between the telephone instrument in the elevator car or cars to a stationary external point.

In view of the inherent difficulty in establishing a plurality of electrical circuits to the moving cages of a circuitous elevator, and the undesirable features of the circuit-establishing means disclosed in the aforementioned pending application, we have devised a solution, in our present invention, for the problems presented, which enables a continued electrical connection between a plurality of endless trolleys and a plurality of contact points on a cage, the latter being displaced from the point of pivotal support of the cage, whereby a plurality of electrical circuits, completely insulated from the metallic structure of the elevator and not employing it as a part of any circuit, are continuously maintained to all of the cars.

It is, therefore, an object of our invention to maintain a continuous, insulated, multi-circuit electrical connection between the movable cars or cages of a circuitous elevator and between the cars and stationary elements external to the moving system of cages, whereby the practical operation of a circuitous elevator, particularly for passenger service, is assured.

Another object of our invention is to provide an electrical control system for a circuitous elevator, embodying a control means on one or more of the cages, for reversibly controlling the operation of the elevator and affecting a full control of the elevator in either direction.

Other objects of our invention will be apparent from the following specification, when read in connection with the accompanying drawings wherein,

Figure 1 is a partially diagrammatic view, showing a vertical section of a building having a plurality of superposed floors and a circuitous elevator, embodying our present invention, suitably disposed therein.

Fig. 2 is an enlarged fragmentary side elevational view, showing the means for effecting the completion of the electrical circuits with respect to the moving cages.

Fig. 3 is an enlarged fragmentary front elevational view, showing a portion of one of the endless chains of a circuitous elevator, embodying our invention, parts being broken away, to show the cage-supporting means and a portion of the means for effecting the electrical connections to the cages.

Fig. 4 is an enlarged view, corresponding to Fig. 3, showing, with greater clarity, the means for effecting the electrical connections to the movable cages.

Fig. 5 is a fragmentary view, partially in section, taken on the line V—V of Fig. 4.

Fig. 6 is a diagrammatic illustration of the control circuit embodied in the present invention.

Referring to Fig. 1, we have provided a circuitous elevator comprising a plurality of cages 11 movable in a hatchway 12 extending past a plurality of floors 13 in a building 14. The details of the structure of the circuitous elevator, as shown, are immaterial to the application of our invention thereto; however, for the purpose of rendering our invention more readily understandable, each cage 11 is shown as movably supported in a sling 15 which is pivotally suspended from and between a pair of endless flexible member, such as chains 16, each being in the form of a loop and being disposed vertically in spaced parallel relation. Suitable sprocket wheels or sheaves 17 are provided for supporting the endless chains at the upper and the lower extremities thereof for movement in an endless path, each sprocket wheel being suitably supported from the building structure in any suitable manner, such as, for example, by means of a stub shaft 18 rotatably retained in bearings 19 mounted on the building structure.

Suitable guideways 25, stationarily disposed, for engaging the vertically extending portions of the endless chains are provided in order to maintain the endless chains in fixed vertical paths of movement. Referring to Figs. 3, 4 and 5, the guideways 25 are illustrated as comprising angle-bars 26, suitably secured to the walls of the building structure in the hatchway 12, for engaging opposite sides of an endless chain.

The slings or rectangular frames 15 are constructed similarly to the slings usually employed for supporting elevator cars in elevator systems of the reciprocating type. Suitable trunnion members 27 are secured to the opposite sides thereof, at the upper corners, for pivotally engaging endless chains in such manner as to take the place of the usual pin or pintle for connecting the links of a chain.

Although not so illustrated in the drawings accompanying our present invention, it is, nevertheless, intended that the cars shall be, preferably relatively movable in the supporting slings 15. Any suitable means, such as that described and claimed in the above-mentioned copending application Serial No. 414,683, may be provided for movably supporting a car in its sling, whereby it can move above or below a normal position and thus adjust its position to the exact level of a floor at which it is stopped.

The number of cars employed in a circuitous elevator is, of course, determined by the number of passengers to be transported, as well as by the nature of the service to be rendered, either "express" or "local". Therefore, although we have illustrated a circuitous elevator in Fig. 1 as comprising a number of cars equal to twice that of the number of floors in the building, it should be understood that the number of cars is variable.

Any suitable means for driving the circuitous elevator, that is, for moving all of the cars simultaneously, may comprise a driving gear mechanism, including a pair of driving sprocket wheels 23, disposed for rotation in the plane of one of the endless chains and suitably secured to parallel spaced shafts at the same level to engage, respectively, the vertically extending portions of an endless chain. The simultaneous rotation of the sprocket wheels 23 at the same speed and in the same direction is effected by means of an intervening speed-reducing gear

mechanism 30, connecting the sprocket wheels to a suitable motive means, such as an electric motor 29, stationarily mounted in a suitable place on the building structure.

Our invention comprises an endless trolley system, including a plurality of endless conductors or trolleys 31, 32, 33, 34, 35 and 36 (see Figs. 2 and 6) suitably secured at intervals by adjustable clamps 37 to insulating members 38 attached to the angle-bars 26 or to the walls of hatchway 12 by angle brackets 39. The trolleys, which have a contour similar to that of the endless chains 16, are disposed externally adjacent to one of the chains, and in spaced concentric relation to one another, in the same plane. They may be also otherwise suitably disposed, as, for example, in coaxial spaced relation or be made of equal or unequal lengths. A modification of the manner of mounting the trolleys may be employed which consists in embedding the trolleys in a common, flexible, insulating matrix, or supporting base and suitably securing the matrix to the walls of the hatchway.

Each of the elevator cars 11 is provided with a plurality of spaced concentric rings or annular conductors 41, 42, 43, 44, 45 and 46, (see Figs. 2 and 5) which have, preferably, a cross-sectional area similar to that of the stationary trolleys and are disposed concentrically in the same plane and secured by clamps 49 to an insulating collar member 47 which is rigidly attached, as by set-screws 48 in the hub thereof, to one of the trunnion members 27, in such manner that each ring on each cage is in alignment with one corresponding stationary endless trolley. In order to reduce the size of the drawing, only three trolleys and three rings are shown in Fig. 5.

The potential to be impressed on the trolleys is preferably of low order for the purpose of allowing the rings and trolleys to be closely spaced and thus reduce the total space required thereby.

The rings are secured to the insulating collar 47 in spaced relation, with respect to the trolleys, such that an insulating arm 50, having a plurality of pairs of resilient, electrically-connected and conducting contact-fingers 51 and 52 thereon, is interposed therebetween to cause the contact-fingers of each pair to individually effect a sliding contact between the concentric rings on a cage and the corresponding stationary endless trolleys.

One contact-finger arm 50 is provided for each of the elevator cars and it is rigidly secured to one of the links, comprising the endless chain, adjacent to the stationary trolleys, on the interior side thereof, and a short distance removed from the pivotal connection of the trunnion member 27 of the associated elevator car, with the endless chain.

Thus, when relative movement of an elevator car and the endless chains occurs, such as during movement of the elevator cars around the upper and lower sprocket wheels 17, a continuous electrical connection is maintained between the stationary trolleys and the concentric rings on the elevator cars, the contact-finger arm 50 effecting this result for all the relative positions between a car and the endless chains. This fact is clearly shown in Fig. 2, where the contact-finger arm 50 is on the right side of the concentric rings in one position of the elevator car, and on the left side of the concentric rings in another position of the car.

Referring to Fig. 6, a specific embodiment of a control system for controlling and operating a circuitous elevator, by employing the portion of our invention just described, is illustrated. It comprises briefly, a clockwise-direction relay 55 and a counter-clockwise direction relay 56 for controlling the actuation of the driving motor 29, the relays being selectively energizable by means of a reversing control switch 57 on one or more of the elevator cars.

The control switch 57 is preferably of a well known double-throw type for establishing one circuit when moved to a position on one side of a neutral position and another circuit when moved to the opposite side of the neutral position. A contact member 58, engageable by a contact member on a control lever 57' when the latter is moved to one side of its neutral position, is provided on the switch 57, and is connected, by an electrical conductor, either flexible or rigid, to the ring 42 on the corresponding car. A similar contact member 59 on the opposite side of the neutral position of the control lever 57' is similarly connected to the ring 43 on the corresponding car. One terminal of the coil of relay 55 is permanently connected to the endless trolley 32, and a corresponding terminal of the coil of relay 56 is permanently connected to the endless trolley 33.

The contact member of the control lever 57' is connected to the ring 41, and the trolley 31 is permanently connected to one supply conductor L1 of a source of potential.

Thus, by causing the contact member of the control lever to engage contact member 58, relay 55 is energized to cause the motor 29 to be actuated to move the elevator in a clockwise direction; and, by so moving the control lever that the contact member thereof engages the contact member 59, the relay 56 is energized to cause the motor to be actuated to rotate in a direction to move the elevator in a counter-clockwise direction.

An emergency-stop push-button switch 60, of well known construction, is provided in the circuit connecting the control lever 57' to the ring 41 in order that the circuit may be interrupted at any time to effect the immediate stopping of the elevator.

The cooperation of the reversible controller and the emergency switch renders the operation of a circuitous elevator possible to remove any jamming obstruction that may stop the elevator. For example, when the elevator is stopped by striking a jamming obstruction, the emergency switch may be operated to immediately open the control circuits. The controller may then be reversed, and the elevator car backed from the obstruction so that the obstruction may be removed.

A plurality of safe-switches 61, of well known construction, are provided, one for the hatchway door at each floor, each being operable, by its associated door, to a closed position, when the door is completely closed. All of the door switches 61 are connected in series in the circuits for energizing the coils of the relays 55 and 56 and thus prevent the actuation of the relays when any hatchway door is not completely closed.

A lamp 62 is provided for each of the cars and is secured, preferably, to the ceiling thereof. The electrical connections from an external sta-

tionary source of potential L1, L2 to the lamp, are made by means of the trolleys 31 and 34 and the rings 41 and 44 on the associated car. A switch 63 is provided on each car for interrupting the connections to the lamp 62 on the same car and, when the switch is closed, the lamp is continuously illuminated, regardless of the position of the elevator car or its rate of movement.

A telephone instrument 64 is provided on one or more of the cars and the electrical connections thereto from stationary outside elements, including a battery or source of electrical energy 83, are made through the trolleys 35 and 36 and the rings 45 and 46. Thus, audible communication between any car and a stationary outside source or between any car and another or all of the other cars is rendered possible.

Further details of our invention and its operation are best understood by an assumed operation. It should be understood that we contemplate the operation of the elevator by an automatic control system, in the manner described in the above-mentioned copending application #414,683, and employ our control system, illustrated in Fig. 6 of the present application, in conjunction therewith. Our present invention, in effect, thus constitutes an optional method of control when it is desired to unrestrictedly control the speed and movement of an elevator during installation or testing operations, or when the levelling means fails to function and it is necessary to level the elevator cars with the floors at which they are substantially stopped.

For the purpose of better understanding the nature of our invention, let it be assumed that the control lever 57', on a car switch 57 of one of the cars, is moved so that its contact member engages the contact member 59. The operation of the switch 57, in this manner, closes a circuit for energizing the coil of counter-clockwise relay 56 which circuit extends from supply conductor L1, through conductor 70, trolley 31, contact fingers 51 and 52, ring 41, conductor 71, emergency-stop switch 60, conductor 72, control lever 57' and its contact member 59, conductor 73, ring 43, contact fingers 52 and 51, trolley 33, conductor 74, coil of relay 56, conductor 75, normally-closed contact members 3 of clockwise relay 55, conductors 76 and 77, all of the door-interlock switches 61, in series and conductor 78, to supply conductor L2.

Thus, although the operator moves the control lever 57' to an operative position, the elevator will not move until all the passengers are safely in or safely out of all of the elevator cars. It is understood that provision must be made in the door-operating mechanism to prevent a premature closing of cage and hatchway doors, whereby injury to persons entering or leaving an elevator car, having no operator therein, may result. Any well known door-operating mechanism, such as is employed in reciprocating elevator installations, fulfills the necessary requirements to render the operation of the elevator by one operator, stationed in one of the cars, completely safe for passengers.

The normally-open contact members *a*, *b*, *c*, and *d* of relay 56 are closed, and the normally-closed contact members *e* of the same relay are opened when the coil of the relay is energized.

The opening of the contact members *e* opens a circuit for energizing the coil of clockwise relay 55, and, therefore, prevents the simultaneous energization of the two direction relays 55 and 56.

The closing of contact members *a* closes a circuit for energizing the coil 65 of a brake 66, of a well known construction, associated with the driving motor 29. The circuit extends from supply conductor L1, through conductor 79, coil 65, conductors 80 and 81, contact members *a* of relay 56 and conductor 82, to supply conductor L2. The energization of the coil 65 releases the shoe of the brake 66 from its frictional engagement with the drum of the brake, against the force of a spring, and the motor 29 is thus freed for rotation upon energization thereof as a result of the closing of the contact members *b*, *c* and *d* of the relay switch.

The contact members *b*, *c*, and *d* of relay 56 connect the outside terminals of the phase windings X, Y and Z, of the motor 29, to the alternating-current supply conductors AC2, AC3 and AC1, respectively. It is deemed unnecessary to trace these connections in detail because they are sufficiently obvious in Fig. 6.

Although we have not illustrated any means for gradually accelerating or decelerating the motor 29, it should be understood that any of the well known means employed in motor-control systems for effecting these results may be employed.

The extent of movement of the elevator is determined by the operator and, when he desires to stop the elevator in any position, he returns the control lever 57' to its neutral position at the proper time or, in the event that he desires to open the control circuits immediately, as in an emergency, he may open the emergency switch 60.

Let it be further assumed that the control lever is moved to the reverse side of its neutral position so that the contact member thereon engages the contact member 58 on the switch 57. This operation closes a circuit for energizing the coil of relay 55; which circuit extends from supply conductor L1 to the control lever 57', as previously traced, thence by way of contact member 58, conductor 85, ring 42, contact finger 52 and 51, trolley 32, conductor 86, coils of relay 55, conductor 87, normally closed contact members *e* of relay 56, conductor 77, through all of the door interlock switches 61, in series, and conductor 78, to supply conductor L2.

The actuation of relay 55 causes its normally-open contact members *a*, *b*, *c*, and *d*, to close, and its normally-closed contact members *e* to open.

The opening of the contact members *e* of relay 55 prevents the energization of the coil of relay 56 simultaneously with that of relay 55.

The closing of contact members *a* of relay 55, being connected in parallel with contact members *a* of relay 56, effects the energization of the coil 65 of the brake 66 to free the motor 29 for rotation. The rotation of motor 29 to move the elevator cars in a clockwise direction is effected upon the energization of the three-phase windings X, Y and Z by having their outer terminals connected to the alternating-current supply conductors AC3, AC2 and AC1 through contact members *b*, *c*, and *d*, respectively, of relay 55.

Each of the incandescent lamps 62 on the elevator cars is connected to a stationary source of energy, comprising supply conductors L1 and L2, by a circuit extending from supply con-

ductor L1 to the ring 41, as previously traced, thence by conductor 84 to the incandescent lamp, through conductor 89, switch 63, which may be of any suitable type and conveniently located on the car, conductor 90, ring 44, contact fingers 52 and 51, trolley 34, and conductor 91, to supply conductor L2. Thus, as long as the switch 63 on the corresponding car is closed, the incandescent lamp 62 on the car will be continuously illuminated from an external stationary source.

There being two conductors required for the circuit to the telephone instrument 64 on one or more cars, the two outside rings 45 and 46 are employed to effect the connection of the conductors to trolleys 35 and 36, respectively, to which are connected respectively, other conductors by which the circuit is extended to any outside source of supply 83, telephone, annunciator or other signal device. Obviously, switches of any suitable type may be substituted for the telephone instrument to effect the illumination of signal lamps external to the moving system of elevator cars. Also, signal lamps may be disposed in the elevator cars which are illuminated upon the operation of switches or other circuit-closing devices external to the moving system of elevator cars.

The terminals of the source of supply 83 are permanently connected across the trolleys 35 and 36 and thus a common source of energy, whereby communication between a car and any other car or cars may be effected.

It should, therefore, be clear that the practical commercial operation of circuitous elevators for passenger service is assured by employing our present invention. It should also be clear that we have provided a device of novel structure for effecting a multi-circuit electrical connection between the cars of a circuitous elevator, and to the cars from a stationary external source whereby the movement of all the cars may be fully and reversibly controlled, whereby energy for an illuminating means in each of the cars is supplied from a stationary external source and whereby communication between a car and a stationary point, or between cars, is effected.

Although we have illustrated only one embodiment of our invention, it is to be understood, that it is capable of various modifications without departing from the spirit thereof. It is desired, therefore, that no limitations shall be imposed thereon except as imposed by the prior art and set forth in the appended claims.

We claim as our invention:

1. In a circuitous elevator, a plurality of cars movable in an endless path, stationary elements, and means for continuously maintaining at least one electrical circuit between each of said cars and said stationary elements, said means comprising a plurality of concentric rings on each car, a corresponding number of stationary parallel endless trolleys, and movable connecting means for slidably engaging corresponding rings and trolleys.

2. In a circuitous elevator, a plurality of cars movable in an endless path, stationary elements, means for continuously maintaining at least one electrical circuit between each of said cars and said stationary elements, said means comprising a plurality of concentric rings on each car, a corresponding number of stationary endless trolleys, and means, for each car, movable in accordance with the movement of all of said cars, for slidably engaging and connecting said trolleys and corresponding rings on the cars.

3. In a circuitous elevator, a pair of endless flexible members disposed vertically in spaced parallel planes, means supporting said endless members for movement in similar endless paths, a plurality of cars pivotally suspended at intervals from and between said endless flexible members, stationary elements, and means for continuously maintaining at least one electrical circuit between each of said cars and said stationary elements, said means comprising a plurality of stationary endless trolleys, a plurality of concentric rings on each car, and means for each car, secured to one of said endless flexible members in associated relation to its corresponding car for slidably engaging and connecting said trolleys and the corresponding rings on the cars.

4. In a circuitous elevator, a plurality of cars movable in and endless path, stationary elements, means for continuously maintaining at least one electrical circuit between each of said cars and said stationary elements, said means comprising a plurality of concentric rings on each car, said rings being disposed in a vertical plane, a corresponding number of stationary endless trolleys, and means for each car, movable in accordance with the movement of all of said cars, for slidably engaging and connecting said trolleys and corresponding rings on the cars.

5. In a circuitous elevator, a plurality of cars movable in an endless path, stationary elements, means for continuously maintaining at least one electrical circuit between each of said cars and said stationary elements, said means comprising a plurality of spaced concentric rings on each car, a corresponding number of stationary, spaced, endless trolleys disposed in a vertical plane, and means for each car, movable in accordance with the movement of all of said cars, for slidably engaging and connecting said trolleys and corresponding rings on the cars.

6. In a circuitous elevator, a plurality of cars movable in an endless path, stationary elements, means for continuously maintaining at least one electrical circuit between each of said cars and said stationary elements, said means comprising a plurality of spaced concentric rings on each car, a corresponding number of spaced endless trolleys, said rings and said trolleys being disposed respectively in two spaced vertical planes, one ring on each car being in alignment with a corresponding one of said trolleys, and means for each car, movable in accordance with the movement of all of said cars, for slidably engaging and connecting said trolleys and corresponding rings on the cars.

7. In a circuitous elevator, a pair of endless chains, vertically disposed in spaced parallel relation, a plurality of cars, trunnion members for pivotally suspending said cars from and between said endless chains, stationary elements, means for continuously maintaining at least one electrical circuit between each of said cars and said stationary elements, said means comprising a plurality of spaced rings on each of said cars, disposed concentrically with respect to one of the trunnion members for each car, a corresponding number of stationary endless trolleys, and means for each car, movable in accordance with the movement of all of said cars, for slid-

ably engaging and connecting said trolleys and their corresponding rings on the cars.

8. In a circuitous elevator, a pair of endless chains vertically disposed in spaced parallel relation, a plurality of cars pivotally suspended from and between said endless chains, stationary elements, means for continuously maintaining at least one electrical circuit between each of said cars and said stationary elements, said means comprising a plurality of spaced concentric rings on each of said cars, a corresponding number of endless trolleys externally parallel with respect to said endless chains, and means for each car attached to one of said endless chains and disposed for slidably engaging and connecting said trolleys and rings on the corresponding car.

9. In a circuitous elevator, a plurality of cars movable in an endless path, motive means for moving said cars, means on at least one of said cars for reversibly controlling the movement of said cars, stationary control means actuable in response to the operation of any one of said reversible control means on the cars for effecting the energization of said motive means, and means for continuously maintaining a connection between said control means on the cars and said stationary control means, said connecting means comprising a plurality of concentric rings on each car, a corresponding number of stationary trolleys, and movable means for slidably engaging and connecting the rings and their corresponding trolleys.

10. In a circuitous elevator, a plurality of cars movable in an endless path, stationary elements, and means for continuously maintaining at least one electrical circuit between at least one of said cars and said stationary elements, said means comprising a plurality of endless conducting strips disposed parallel and adjacent to the path of movement of said cars and parallel to each other, a plurality of conducting means corresponding in number to the number of said endless conducting strips and disposed to move with said car in a plane parallel to the plane of said strips, and means movable with said car for maintaining an electrical connection between corresponding conducting strips and conducting means throughout the path of travel of said car.

11. In a circuitous elevator, a plurality of cars movable in an endless path, stationary elements, and means for continuously maintaining at least one electrical circuit between at least one of said cars and said stationary elements, said means comprising a plurality of endless conducting strips disposed parallel and adjacent to the path of movement of said cars and parallel to each other, a plurality of conducting means corresponding in number to the number of said endless conducting strips and disposed to move with said car in a plane parallel to the plane of said strips, and means movable with said car and relative to said conducting means for maintaining an electrical connection between corresponding conducting strips and conducting means throughout the path of travel of said car.

12. In a circuitous elevator, a plurality of cars movable in an endless path, a plurality of stationary conducting elements disposed adjacent to the path, a plurality of conducting elements disposed to move with the car, and means for electrically connecting said first named conducting elements, and said second named conducting elements, said connecting means being movable with the car and movable relative to said first named conducting elements and to said second named elements for continuously maintaining electrical connection between the car and the stationary conducting elements.

HENRY D. JAMES.
HAROLD E. WHITE.