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Ozawa

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[45] **Dec. 11, 1973**

[54] **ELEVATOR FLOOR SELECTOR**

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[73] Assignee: **Mitsubishi Denki Kabushiki Kaisha**, Tokyo, Japan

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[52] **U.S. Cl.** ..... **187/29 R**

[51] **Int. Cl.** **B66b 1/52**

[58] **Field of Search** 187/29

[56] **References Cited**

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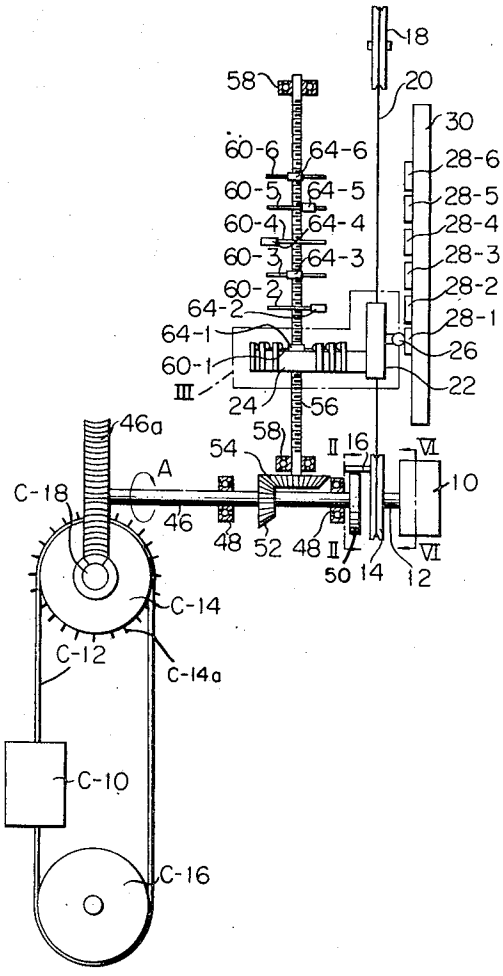
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Assistant Examiner—W. E. Duncanson, Jr.
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[57] **ABSTRACT**

A plurality of control discs are mounted on a vertical shaft at those positions corresponding to those floors of a building. The shaft is rotated in response to the travel of an elevator car. An advance element carrying a plurality of deceleration switches is moved ahead of the travelling car at a predetermined advance range. When the advance element reaches and stops at the particular calling floor, an actuator disposed on that disc for the calling floor continues to be rotated to successively operate the switches to decelerate the car until it lands at the calling floor.

3 Claims, 9 Drawing Figures



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SHEET 1 OF 2

FIG. 1

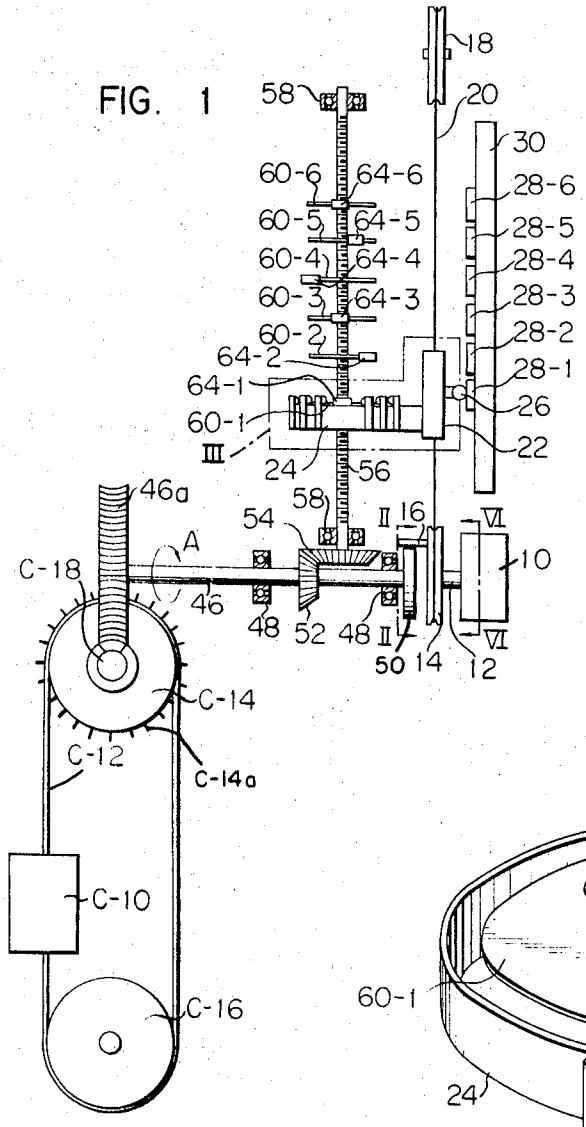


FIG. 2

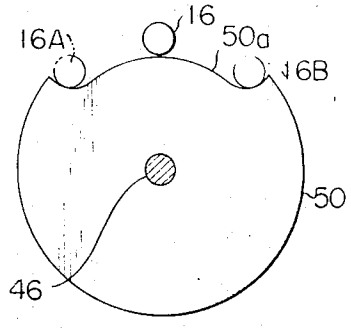


FIG. 3

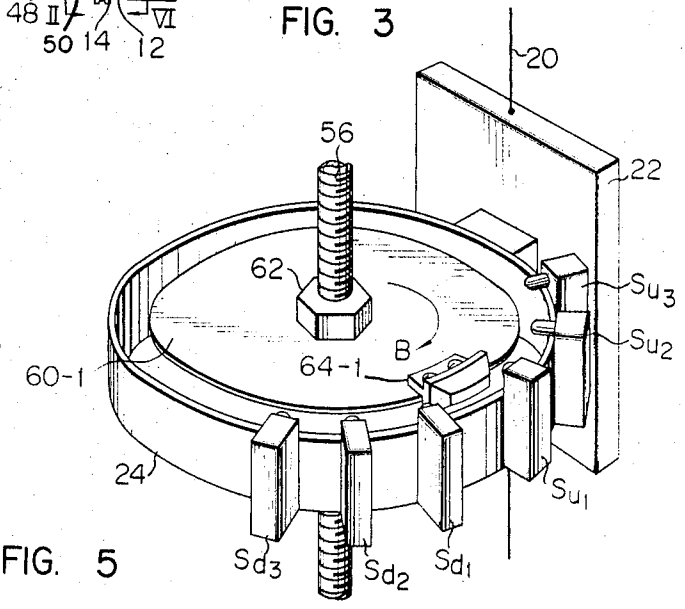


FIG. 4

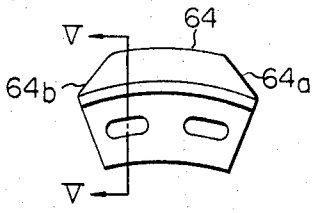
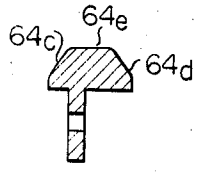


FIG. 5



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FIG. 6

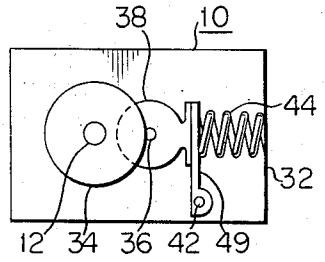


FIG. 7
PRIOR ART

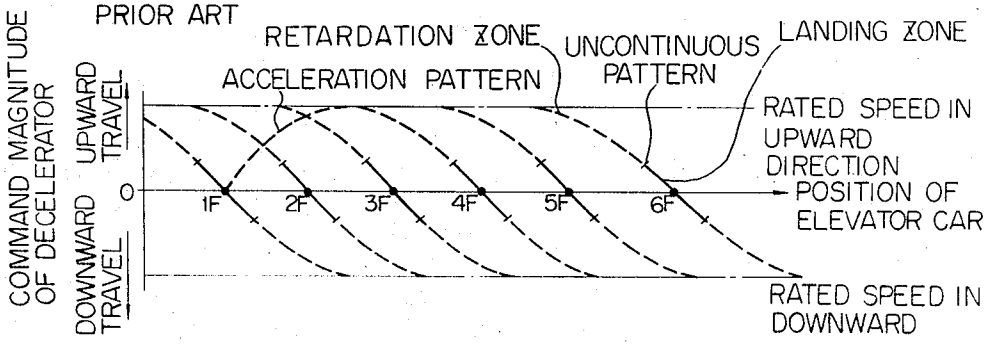


FIG. 8

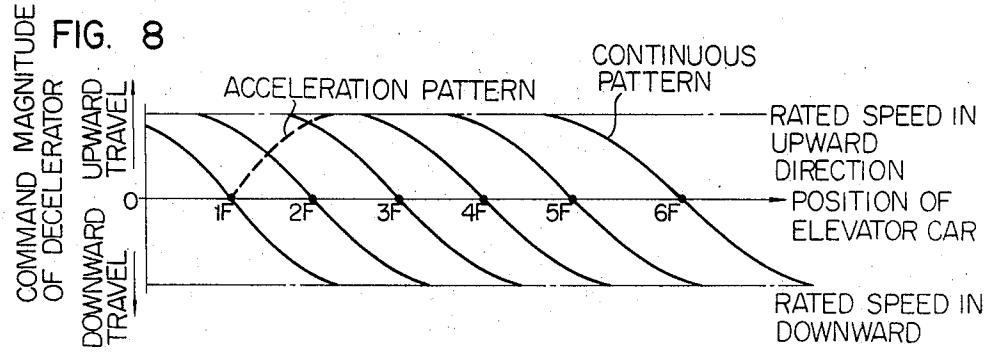
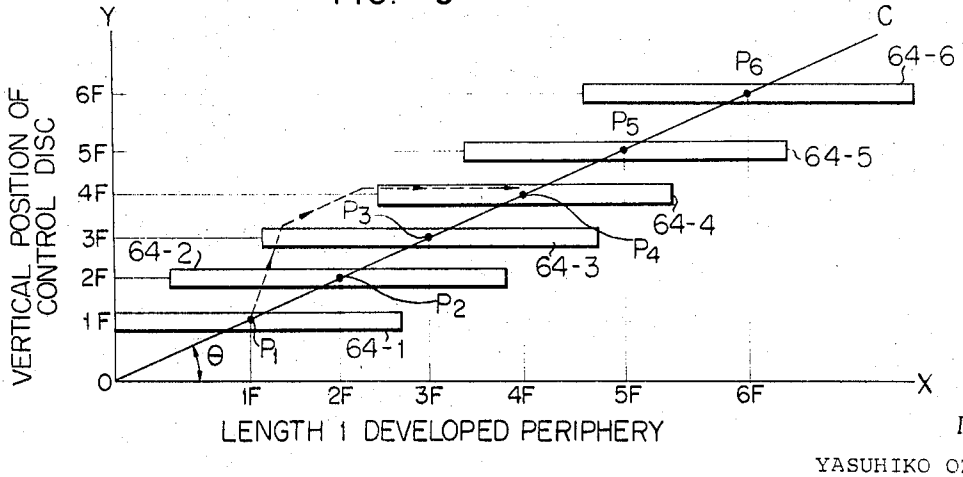


FIG. 9



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ELEVATOR FLOOR SELECTOR

BACKGROUND OF THE INVENTION

This invention relates to floor selectors for use with an elevator system.

In elevator systems the floor selector is used to generate a position-to-speed pattern for determining a deceleration of the associated elevator car from its rated speed to its landing at a selected one of the floors of the building. The conventional type of floor selectors have included one moving member operatively associated with each elevator car to effect a movement reduced to a fraction ($1/k$) of the actual movement of the car where k is a reduced scale, and one floor reference element or floor stop disposed along the path of movement of the moving member at a position corresponding to that of each floor. Then the position of the moving member relative to that floor stop for a selected one of the floors at which the associated elevator car is to land is mechanically or electrically sensed to generate a deceleration pattern required for that car to be decelerated and stopped at the selected floor. In this system the positional accuracy of such a deceleration pattern computed in terms of a magnitude of movement of the elevator car within its shaft depends upon the error made by the floor selector and multiplied by the value of the reduced scale (k). Since conventional floor selectors have a reduced scale usually ranging from 80 to 160 due to a limitation as to the height thereof, it has been difficult to provide a deceleration pattern with a high positional accuracy as desired. Also the deceleration pattern has been generated on the basis of the position of the associated floor stop. Therefore the floor stops have been required to be very carefully disposed along the path of movement of the moving member with a maximum possible accuracy.

In order to improve the positional accuracy of the deceleration pattern to land an elevator car exactly at a selected floor, there have been previously proposed means operatively associated with the moving member to generate a deceleration pattern under low speed conditions or in the landing zone which is, in turn, with the deceleration pattern under high speed conditions or in the retardation zone generated by the moving member. The deceleration pattern under low speed conditions usually has a reduced scale of from 5 to 40 which is much smaller than the first mentioned reduced scale. The latter pattern can also originate from the actual position of the associated elevator car within its shaft. Both patterns are generally interconnected at a position usually spaced away from each floor by a distance of from 250 to 1,000 mm. In that event a deceleration pattern in the retardation zone is preferably merged into that in the landing zone to form a joint-free or continuous pattern over the total deceleration range, in order to ensure the comfortable ride in the elevator car. In effect, however, it has been difficult to provide a continuous deceleration pattern free from any discontinuity because the pattern in the retardation zone originates from the associated floor stop required to be positioned with a high positional accuracy and further because of the large reduced scale as above described.

Also there are already known floor selectors of another type utilizing a rotating member in the form of a disc. In this type of floor selector, deceleration switches adapted to be operated in response to the rotational movement of the rotating member have been disposed

a synchronizer moved in synchronization with the travel of the associated elevator car but on a reduced scale. This measure has led to the necessity of imparting to the disc-shaped rotating member a helical surface the pitch of which is equal to an incremental movement of the synchronizer along the rotatory shaft of the rotating member for each complete rotation of the shaft. The disc-shaped rotating members representative of the positions of the respective floors along the rotatory shaft thereof have been required to be positioned on a helical path defined by such a helical surface resulting in the formation of the rotating member into a helical sector. Under these circumstances, if the total deceleration range for the elevator car exceeds one half the vertical distance between the adjacent floors then there has not been theoretically provided a joint-free or continuous deceleration pattern having a small reduced scale such as above described.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the invention to provide a new and improved floor selector for use with an elevator system for generating a deceleration pattern for determining the deceleration of the associated elevator car from its rated speed to its landing at a selected one of floors the with a high accuracy not affected by the positional accuracy of a moving member and which is inexpensive to manufacture.

It is another object of the invention to provide a new and improved floor selector for use with an elevator system for providing a deceleration pattern required for the associated elevator car to decelerate from its rated speed to a zero speed at which the car lands at a selected one of the floors which pattern has no joint nor discontinuity over the entire deceleration range.

It is still another object of the invention to provide an improved floor selector for use with an elevator system which is inexpensive to manufacture which has a high accuracy by using a large value for a first reduced scale independent of the positional accuracy of a moving element and a small value of a second reduced scale dependent on that accuracy.

It is also one of the objects of the invention to provide a new and improved floor selector for use with an elevator system having a higher accuracy than that previously obtained and which does not require the floor stops or other elements to be disposed with a high positional accuracy.

The invention accomplishes these objects by the provision of a floor selector for use with an elevator car serving a plurality of floors of a building, comprising, a driving shaft rotated in response to the travel of an elevator car, one control element disposed at a position corresponding to that of each of the floors along the driving shaft to be driven by the driving shaft, and a signalling element moved along the rotating shaft and ahead of the traveling elevator while being engageable by each of the control elements at the position corresponding to that of each floor. When the signalling element reaches a selected one of the positions corresponding the floors, the rotational movement of that control element disposed at the selected position causes the signalling element to generate a signal in accordance with the actual position of the traveling elevator car.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic view of an elevator floor selector constructed in accordance with the principles of the invention;

FIG. 2 is a diagrammatic plan view taken along the line II—II of FIG. 1 in the direction of the arrows;

FIG. 3 is a perspective view on an enlarged scale of the elements enclosed by the dot-dash line III in FIG. 1;

FIG. 4 is a plan view of the actuator shown in FIG. 3;

FIG. 5 is a sectional view taken along the line V—V of FIG. 4 in the direction of the arrows;

FIG. 6 is a schematic plan view taken along the line VI—VI of FIG. 1 as viewed in the direction of the arrows;

FIG. 7 is a graph illustrating deceleration patterns produced by a floor selector of the prior art type;

FIG. 8 is a graph illustrating deceleration patterns produced by the arrangement shown in FIG. 1; and

FIG. 9 is a graph useful in explaining the principles of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention contemplates eliminating the floor stops as above described and other elements disposed with a high positional accuracy. The omission of the floor stops permits various components to be disposed in this place with relatively large tolerances ecen though the first reduced scale as above described is used for some reasons. This is because the position occupied by each of those components is not a direct factor in determining the accuracy with which the deceleration pattern is generated.

The invention also contemplates disposing the above-mentioned deceleration switches on an advance element rather than on the synchronizer as above described, which element is adapted to be moving ahead of the associated traveling elevator car while maintaining a predetermined range necessary and sufficient to decelerate and stop the traveling car. When the advance element senses a floor having a floor call registered thereon, it stops at its position representative of the calling floor. This measure permits a simple flat disc to be substituted for the helical sector as above described and will produce a deceleration curve with a high positional accuracy along which the elevator car is decelerated and lands at the selected one of the floors. The curve will continuously spread over the entire range of deceleration required for the traveling car to decelerate and stop at the selected floor. This is, the curve is free of discontinuities.

Referring now to the drawings and FIG. 1 in particular, it is seen that the arrangement disclosed herein comprises a drive device schematically designated at block **10**, a horizontal output shaft **12** projecting from the drive device **10**, and a sprocket wheel **14** rigidly secured on the output shaft **12** at the free end and having a pin **16** on that face remote from the drive device **10**. The sprocket wheel **14** is also vertically aligned with another sprocket wheel **18** disposed above the same and a length of chain designated at line **20** passes over both sprocket wheels **14** and **18**. A driven advance element **22** is connected in the length of chain **20** and carries thereon a support member **24**. A collector contact **26** is disposed on a face of the advance element **22** substantially parallel to the tensioned chain **20** and adapted to selectively engage by a plurality of stationary contacts **28-1, 28-2, . . . , 28-6** disposed on a vertical board **30** of any suitable electrically insulating material at predetermined intervals proportional to spacing between adjacent floors of a building served by the associated elevator car although the floors car are not illustrated in FIG. **1**. Only for purpose of illustration it is assumed that the stationary contacts **28** are positioned on the board **30** on the basis of the first or larger reduced scale as previously described. The stationary contacts **28-1, 28-2, . . . , 28-6** are respectively connected to electric contacts of call relays (not shown) disposed on the first, second, third, fourth, fifth and sixth floors.

As shown in the lower and lefthand portion in FIG. **1**, the elevator car designated by C-**10** is connected in a length of perforated flexible tape C-**12** which, in turn, extends between a drive pulley C-**14** disposed in a machine room (not shown) and an idle pulley C-**16** disposed adajcent the bottom of an elevator shaft (not shown). The drive pulley C-**14** has a plurality of projections C-**14***a* at equal angular intervals on the outer periphery to engage perforations (not shown) in the tape C-**12**, thereby to prevent the tape C-**12** from slipping along the pulley C-**14**. The pulley C-**14** has also a worm shaft C-**18** fixed coaxially thereto for purpose which will be apparent hereinafter.

The drive device **10** is shown in FIG. **6** as including a housing **32** through which the output shaft **12** rotatably extends. Within the housing **32** a friction wheel **34** is mounted on the output shaft **12** in frictional engagement with a rotary shaft **36** of a driving electric motor **38**. A bracket **40** is pivotably secured on a pin **42** suitably fixed to the housing **32** and sandwiched between the motor **38** and one side wall of the housing **32** through a compression spring **44** located between the same and that side wall. The compression spring **44** serves to bias the motor **38** toward the output shaft **12** to cause the motor shaft **36** to engage the friction wheel **34** with a force higher than the force required for the output shaft **12** to drive the advance element **22** through the sprocket wheels **14, 18** and the chain **20**. However, the spring **44** is prevented from applying an excessively high force to the associated components when the pin **16** reaches either of the ends of its stroke as will be described hereinafter.

Referring back to FIG. **1**, an operating rod **46** is disposed coaxially with the output shaft **12** and rotatably supported by a pair of bearings **48** to be rotated in synchronization with the travel of the associated elevator car (C-**10**). A restricting disc **50** is rigidly secured on the operating rod **46** at that end adjacent the output shaft **12** and directly opposite to the lower sprocket wheel **14**. As best shown in FIG. **2**, the restricting disc **50** is provided at the outer peripheral edge with a notch **50a** in which the pin **16** on the sprocket wheel **14** is engaged. The notch **50a** has a circumferential length sufficient to establish the end positions **16A** and **16B** of the pin **16** when the advance element **22** is at a predetermined maximum advance range ahead of the traveling elevator car in each of the up and down directions which will be described hereinafter. At that time, the

pin **16** abuts against either of the ends of the notch **50***a*. For example, the pin **16** can reach the lefthand end as viewed in FIG. **2** of the notch **50***a* as shown by the dotted circle **16A** in FIG. **2** in the up direction. In the down direction, the pin **16** will reach the righthand end of the notch **50***a* as shown by the dotted circle **16B** in FIG. **2.** Thereafter the pin **16** is prevented from being further rotated with respect to the restricting disc **50** and is forced to follow the rotational movement of the latter. By the term "maximum advance range" is meant a range over which an elevator car travels while it decelerates in accordance with a predetermined deceleration pattern until the car lands at the adjacent floor.

As shown in FIG. **1,** a small bevel gear **52** is mounted on the operating rod **46** intermediate both ends in mesh with a large bevel gear **54** which is, in turn, connected to a vertical driving shaft **56** rotatably supported at the upper and lower ends by a pair of bearings **58.** The shaft **56** is threaded substantially throughout the length thereof.

Referring now to FIG. **3,** the support member **24** on the advance element **22** is in the form of a ring or a hollow cylinder of relatively short length connected to the advance element **22** by an arm. The cylindrical support member **24** has a plurality of ascending deceleration switches S_{u1}, S_{u2} and S_{u3} and a plurality of descending deceleration switches S_{d1}, S_{d2} and S_{d3} such as microswitches disposed at predetermined positions on the outer peripheral surface. The threaded shaft **56** centrally extends through the cylindrical support member **24** and has a plurality of control discs **60-1, 60-2, . . . 60-6** mounted thereon in spaced, parallel relationship one for each of the floors as shown in FIG. **1.** The positions of these control discs represent those of the corresponding floors along the axis of the shaft **56** and on the basis of the first reduced scale as above described. Therefore the control discs are substantially level with the centers of the stationary contacts **28** on the vertical board **30.** For example, the control disc **60-1** is fixedly secured on the shaft **56** at a position corresponding to that of the first floor by a pair of nuts **62** (only one of which is illustrated in FIG. **3**) screw threaded onto the shaft **56** to firmly sandwich the disc **60-1** therebetween.

The control discs **60-1, 60-2, . . . 60-6** have on the peripheries respective actuators **64-1, 64-2, . . . 64-6** in the form of truncated prisms of rectangular cross section adapted to selectively engage the deceleration switches on the cylindrical support member **24.** As best shown in FIGS. **4** and **5,** the actuator **64** includes four lateral faces **64***a*, **64***b*, **64***c* and **64***d* and a top face **64***e* directed radially of the associated control disc **60.** The lateral faces are at such angles to the top face that the actuator is permitted to selectively engage the switches on the support member **24** via any one of the lateral faces without any hindrance. The control discs **60** with the actuator **64** are so dimensioned that the control disc can freely pass through the moving hollow cylindrical member **24** while the actuator can engage and actuate that switch on the member **24** facing the same.

When the elevator car is located at a selected one of the floors, for example, the first floor, the actuator **64** on the corresponding control disc **60** such as the actuator **64-1** is located between the switches S_{u1} and S_{d1} and prevented from actuating any of the switches S_u and S_d as shown in FIG. **3.** The remaining control discs **60** and actuators **64** pprovided for the floors **2**through **6** are identical in construction and arrangement to those shown in FIG. **3.**

The arrangement thus far described is operated as follows: The drive device **10** is arranged to start simultaneously with or slightly prior to the starting of the associated elevator car and such that the direction of movement of the advance element **22** is identical with the direction of movement of the car. The drive device **10** has a driving speed equal to twice the rated speed of the elevator car or more. If the drive device **10** is started early, the driving speed may be equal to one and a half times the rated speed of the car or more. It is essential that the drive **10** should always drive the advance element **22** such that it is sufficiently far ahead of the traveling elevator car that it maintains a deceleration range required for the car to begin to be decelerated from its actual speed in accordance with a predetermined deceleration pattern until it lands at a selected one of the floors. The drive device **10** stop driving the advance element **22** in response to the sensing of the particular calling floor by the latter.

Assuming that an elevator car operatively associated with the arrangement of FIG. **1** is located at the first floor, the collector contact **26** on the advance element **22** is in engagement with the stationary contact **28-1** as shown in FIG. **1** and the pin **16** on the sprocket wheel **14** is positioned at the midpoint of the notch **50***a* on the restricting disc **50** as shown in FIG. **2.** Also, as above described, the actuator **64-1** on the control disc **60-1** is positioned intermediate the switch S_{u1} and the switch S_{d1}.

Under these circumstances, it is assumed that a floor call has been registered on the four floor to produce an instruction for moving the associated elevator car from the first floor upwardly or in the up direction. This causes the drive device **10** to be rotated, for example, in the direction of the arrow A shown in FIG. **1** to permit the pin **16** to move the advance element **22** upwardly along the driving shaft **56** through the sprocket wheels **14, 18** and the chain **20** within the region of the notch **50***a* on the disc **50** and prior to the movement of the elevator car and therefore of the rotatory rod **46.** Thereafter the upward movement of the car is initiated thereby to rotate the rod **46** in the same direction as the drive device **10** or in the direction of the arrow A shown in FIG. **1** through the worm shaft **C-18** and a worm wheel **46***a* mounted on the other end of the rod **46** in mesh with the worm shaft **C-18.** After some time has elapsed, the pin **16** is in engagement with one end **16A** of the notch **50***a*. From that time, the sprocket wheel **14** driven by the drive device **10** is forced to follow the rotational movement of the restricting disc **50** with the result that the sprocket wheel **14** is rotated at the same speed as the disc **50.** In other words, the advance element **22** continues to be moved upwardly at the same speed as the elevator car while the same maintains the maximum advance range as above described ahead of the traveling car in the upward direction.

This upward movement of the advance element **22** is accompanied by the upward movement of the support member **24** during which the actuators **64-1, 64-2** and **64-3** may push against some of the switches S_{u1} through S_{d3} to close them. The closure of the switches has no effect upon the system because the call relay contacts (not shown) connected to the contacts **28-1, 28-2** and **28-3** for the first, second and third floor have no floor call registered thereon.

Upon engagement of the collector contact **26** on the advance element **22** with the stationary contact **28-4** for the fourth floor having a floor call registered thereon, a stop instruction is delivered in a well known manner to stop the rotational movement of the drive device **10** and therefore the upward movement of the advance element **22.** Thus the support member **24** also stops at its relative position around the control disc **60-4** similar to the position shown in FIG. **3,** where the actuator **64-4** can engage and actuate the deceleration switches on the support member **24.** It is to be noted here that the advance element **22** may stop with a positional accuracy sufficient to permit the deceleration switches S_{u1} through S_{d3} on the support member **24** to be engaged and actuated by that actuator **64** facing the support member as will be fully described hereinafter. Usually the advance element **22** has a permissible error of ±2 mm as to its stopping position.

After the advance element **22** has been stopped, the associated elevator car continues to travel in the upward direction so that the operating rod **46** continues to be rotated in the direction of the arrow A shown in FIG. **1.** This is accompanied by a further rotation of the control discs **60-1** through **60-6** in the direction of the arrow B shown in FIG. **3.** Thus the actuator **64-4** on the control disc **60-4** successively actuates the switches S_{u3}, S_{u2}, and S_{u1} in the named order with the result that the car is decelerated and stopped at the fourth floor. Under these circumstances, the elevator car may overshoot the desired floor, in this case, the fourth floor. This causes the actuator **64-4** to actuate the switch S_{d1} to return the car to the fourth floor until the car is stopped at the floor and the disc **60-4** is stopped at such a position that none of the switches SU1 and S_{d1} is operated.

While the ascending and descending deceleration switches S_{u1} through S_{u3} and S_{d1} through S_{d3} respectively are shown in FIG. **3** as being disposed on one portion of the periphery of support cylinder **24** it is to be understood that each set of the ascending and descending switches may be disposed on the periphery of the cylindrical member **24** substantially throughout its length. For example, assuming that the elevator car is stopped at the fourth floor, the ascending deceleration switch S_{u1} is mounted on the periphery of the support cylinder **24** at its position adjacent the actuator **64-4** and the remaining ascending switches S_{u2}, S_{u3}, . . . are distributed on the substantially entire periphery of the cylindrical support member **24** in the named order. On the other hand, the descending deceleration switch S_{d1} is attached to the cylindrical member **24** adjacent that side of the actuator cam **64-4** opposite to the switch S_{u1} and the remaining switches S_{d2}, S_{d3}, . . . are disposed on the substantially entire periphery of the cylindrical member **24** in the named order and in a direction opposite to the direction in which the ascending switches S_{u1}, S_{u2}, . . . are arranged.

During the rotational movement of the disc **60-4** effected between the actuation of that deceleration switch farthest remote from the landing point, in example illustrated, the switch S_{u3} by actuator **64-4** and the landing of the car, for example, at the fourth floor, the car can move a distance somewhat shorter than the maximum advance range given by the advance element **22.** In other words, when the pin **16** is in contact with the restricting disc **50** at one end of the notch **50***a*, the switches S_{u1} through S_{d3} carried by the advance element **24** having stopped in response to a floor call registered on the particular floor can be operated by the actuator **64** on the disc **60** provided for that floor to generate all command signals for decelerating the traveling car from its rated speed in the particular direction of travel to a null speed at its landing point.

For a better understanding of the invention, deceleration patterns or command deceleration curves will now be described in conjunction with FIGS. **7** and **8.** In these Figures, a command magnitude of deceleration is plotted on the ordinate against a position of an elevator car on the abscissa and the zone above the axis of abscissas represents the upward travel while the zone below that axis represents the downward travel of the elevator car. The reference characters 1F, 2F, . . . 6F designate the positions of the first, second, ... and sixth floors.

FIG. **7** shows one deceleration pattern for each floor generated by the prior art type of floor selectors. In the retardation zone in which an elevator car travels at a high speed approximating its rated speed, the car slow down in accordance with a deceleration pattern as shown by a dotted line resulting from that floor stop with a first reduced scale as high as from **80** to **160** provided for a desired floor where the car is to land. Then the car enters the landing zone at a point usually spaced away from that floor by a distance of from 250 to 1,000 mm as previously described. In the landing zone, the speed of the car is groverned by the associated landing pattern as shown by a solid line in FIG. **7** until it lands at the desired floor. The landing pattern is derived by any suitable means provided for that purpose and has a second reduced scale as low as from 5 to 40 as previously described. Alternatively, it may be derived from the actual position of the car within its shaft and have no reduced scale. Under these circumstances, it is inherently difficult to merge the deceleration pattern into the associated landing pattern, that is to say, to interconnect both patterns without any difference in magnitude therebetween at the junction. That is, a discontinuous pattern is generally produced.

The arrangement of FIG. **1** provides a continuous pattern for each floor as shown in FIG. **8.**

The operation of the actuator **64** and the deceleration switches S_{u1} through S_{d3} will now be described in more detail with reference to FIGS. **8** and **9.**

In FIG. **9,** the ordinate OY represents the positions of the floors 1F, 2F, . . . 6F on the basis of the first reduced scale as previously described and the abscissas OX represents the length of the developed periphery of each control disc **60** on the basis of the second reduced scale as previously described. One elongated rectangle at the position of each floor designates a region in which the associated actuator is effective for operating the deceleration switches and is represented by the same numeral as the corresponding actuator. For example, rectangle **64-4** shows such a region for the actuator **64-4.** An oblique line OC is shown in FIG. **9** as passing through the origin **0** with an angle of θ with respect to the axis OX. The angle θ fulfills the relationship $\tan \theta = L/\pi D$ where D is the diameter of the control disc, and L is the magnitude of incremental movement of the elevator car on the first reduced scale for each complete rotation of the disc.

It will readily be understood that the oblique line OC corresponds to the actual movement of the elevator car converted into a helical movement thereof about the

axis of the control shaft **56** on the first reduced scale. All the effective regions of the actuators **64** are of the same dimension and centered at points P_1, P_2, . . . P_6 where the oblique line OC intersects straight lines passing through ordinates of the respective floors and parallel to the axis OX. For example, the region **64-4** is centered at the point P_4.

It is assumed that, as previously described, a floor call has been registered on the fourth floor with the elevator car located at the first floor. Under the assumed condition, the drive device **10** responds to a control signal from a controller (not shown) to start the advance element **22** in the upward direction simultaneously with or immediately prior to the starting of the elevator car **C-10**. The advance element **22** follows a first broken segment of a dotted curve shown in FIG. **9** as starting from the point P_1. Also the elevator car is started and accelerated in accordance with an acceleration curve shown by the thick dot line in FIG. **8**. It is recalled that the speed of the advance element **22** is equal to or higher than two or one and a half times the rated speed of the elevator car as the case may be.

The pin **16** on the sprocket wheel **14** soon reaches the extremety **16A** of the notch **50***a* on the restricting disc **50** (see FIG. **2**). At that time, the advance element **22** is ahead of the traveling elevator car by the maximum advance range at above describdd and simultaneously a separate switch (not shown) is operated to slow down the motor **38** to a speed somewhat higher than that corresponding to the rated speed of the elevator car thereby to decelerate the advance element **22**. Alternatively, the compression spring **44** may be adjusted to permit the friction wheel **34** to slightly slip with respect to the rotating shaft **36** of the motor **38** to attain the same purpose. Therefore the advance element **22** continues to ascend while it keeps the maximum advance range in front of the traveling car. This ascending movement of the advance element is shown by the second broken segment of the dotted curve substantially parallel to the oblique line OC in FIG. **9**.

Then the advance element **22** reaches the fourth floor to engage the collector contact **26** thereon with the stationary contact **28-4** for the fourth floor having the call registered thereon. This causes the motor **38** stop and therefore the advance element **22** to be stopped. However the control disc **60-4** on the control shaft **56** continues to be rotated to permit the associated actuator **64-4** to successively actuate the deceleration switches S_u and S_d to decelerate the elevator car in accordance with the continuous deceleration curve for the fourth floor as shown in FIG. **8** until the elevator car lands at the fourth floor, as above described. The rotational movement of the actuator **64-4** on the control disc **60-4** mounted on the rotating shaft **56** follows the travel of the elevator car on the basis of the second or smaller reduced scale and can be shown by the third broken segment of the dotted curve parallel to the axis OX.

From the foregoing it will be appreciated that the process as above described can be repeated in either of the upward and downward directions for the elevator car, in order to land the car at any desired floor having a floor call registered thereon.

The advance element **22** may be stopped at such a position that the deceleration switches S_u and S_d carried by the advance element **22** occupy positions somewhat deviating from their desired positions relative to the particular control disc **60** on the axis of the control shaft **56**. In other words, the advance element **22** may be stopped at a level slightly higher or lower than that of the particular point of intersection P for example of the point P_4 shown in FIG. **9**. This, however, never affects the positional accuracy of the resulting deceleration pattern as long as the switches are effectively engageable by the actuator opposite thereto. As above described, the actuator **64** includes the top face **64***e* extending for some length in the axial direction of the associated control disc **60** or along the coordinate axis OY as shown in FIG. **9**. Thus a region in which the actuator **64** is enabled to engage each of the deceleration switches has tolerances along the axis OY. This means that, upon mounting the control discs on the driving shaft, the angular positions of the discs and therefore of the actuators relative to a reference can be determined with a higher accuracy and far more easily than the conventional floor stops required to be positioned with a high accuracy on the basis of the first or larger reduced scale. This is because the coordinate axis OX is based upon the second or smaller reduced scale. Also the axial position of each disc on the driving shaft can be determined with a relatively rough accuracy on the basis of the first reduced scale. Thus the advance element carrying the deceleration switches is required only to be selectively stopped along the axis OY with an engaging allowance defined by the top face of the actuator. Since the top face can be a few millimeters long in the axial direction of the associated control disc, the latter may be mounted on the control shaft with an allowance of ±2 millimeters. Further any positional error in the stoppage of the advance element is not acumulative so that it does not affect a further operation of the arrangement as shown in FIG. **1**.

While the invention has been illustrated in conjunction with a single preferred embodiment thereof it is to be understood that numerous changes in the details of construction and the arrangement and combination of parts may be resorted to without departing from the spirit and scope of the invention. For example, the invention is equally applicable to the deceleration of an elevator car from its actual speed less than its rated speed. Instead of the combination of the actuator on the control discs and the deceleration switches, a combination of a magnet and read switches or photocells may be used to produce the required signals. Alternatively, the required deceleration pattern may be generated by electrodynamic induction means comprising an electromagnetic induction plate substituted from each control disc and an electromagnetic coil substituted for each of the deceleration switches. The electromagnetic induction plate and coil have a well known construction but they should be operated with the allowance or tolerances in the coordinate axis OY as above described.

What is claimed is:

1. A signal generator for an elevator serving a plurality of floors of a building, comprising, in combination, a driving shaft rotated in response to the travel of an elevator car, a plurality of control elements disposed along said shaft and fixed at positions corresponding to each of the floors and rotated by said driving shaft, driving means different from that driving the elevator, coupling means comprised of a rotary member rotated in synchronization with the travel of the elevator car and an advance rotary member driven by said driving

means, said advance rotary member engaging and rotating together with said synchronously rotated rotary member after said advance rotary member is rotated by said driving means through at least an angle corresponding to a maximum distance between a floor position and the actual position of the elevator, a signalling element disposed in a plane corresponding to a plane of rotation of said control elements and concentrically disposed around said driving shaft, said signal element having at least one signal generating means thereon engageable by a control element during rotation of a control element within said signalling element, said signalling element being coupled to said advance rotary member and driven thereby along said driving shaft ahead of the elevator, and stop means for each floor disposed along said driving shaft at positions corresponding to said control elements and adapted to be coupled to call buttons for the respective floors to be activated by the call buttons, said stop means being engageable by said signal element in its movement along said driving shaft and being coupled to said driving means for stopping said driving means when activated and engaged by said signal element for stopping the signal element at a control element corresponding to a floor for which a call button has been activated, whereby the signal element stops at a control element corresponding to a floor from which a call has come and the rotation of the control element generates a signal in accordance with the actual position of the traveling elevator.

2. A signal generator as claimed in claim 1 in which said control elements each comprise a flat disc with at least one switch actuator element thereon, and said signal generating means on said signal element comprises at least one switch.

3. A signal generator as claimed in claim 2 in which there are a plurality of switches on said signal element which are adapted to be coupled to the elevator drive means for decelerating the drive means to decelerate the elevator for stopping at the floor from which the call has come.

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