Feb. 22, 1949. J. R. SCHOENBAUM 2,462,781

ELEVATOR POSITION INDICATOR

Filed June 5, 1946 2 Sheets-Sheet 1

Fig. 1.

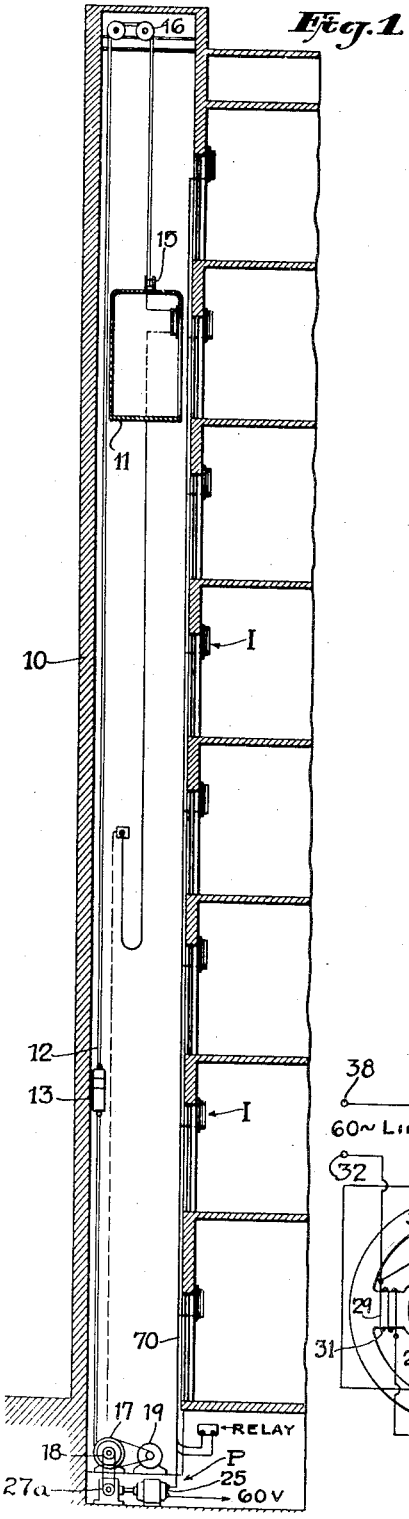
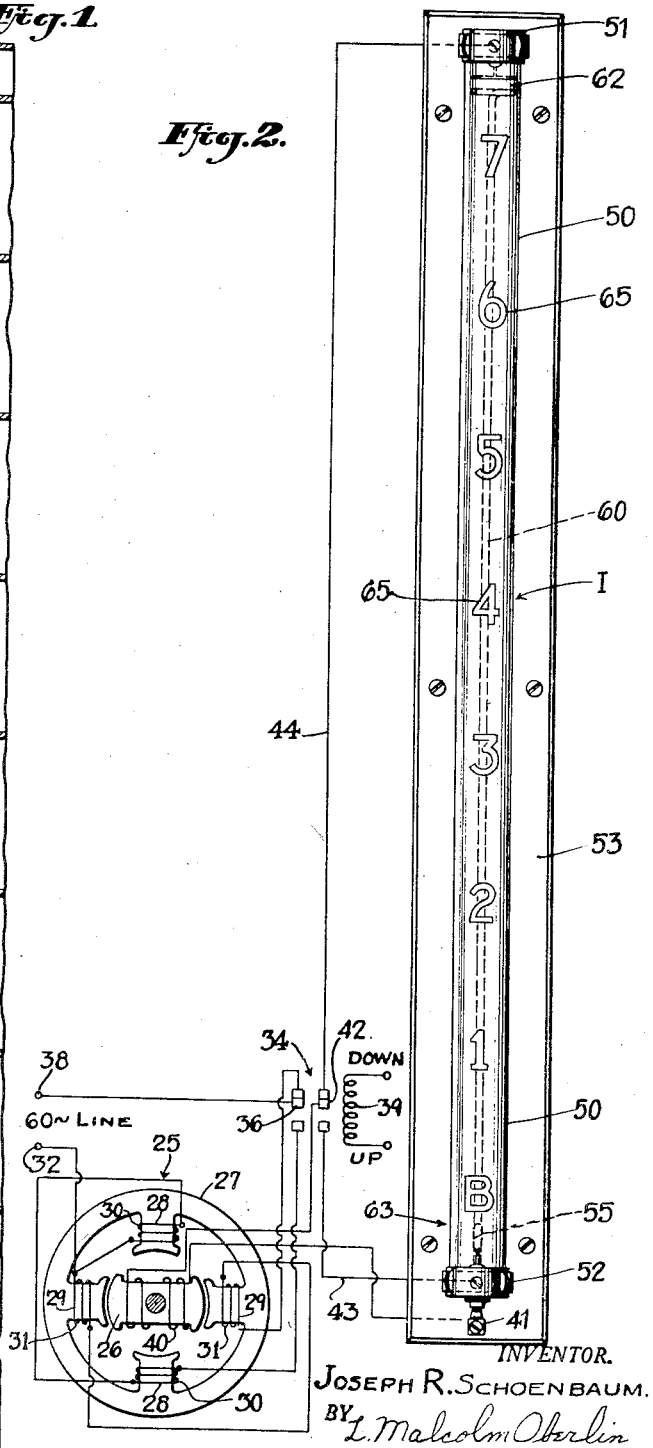


Fig. 2.



INVENTOR.
JOSEPH R. SCHOENBAUM.
BY L. Malcolm Oberlin
ATTORNEY

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Fig. 3.

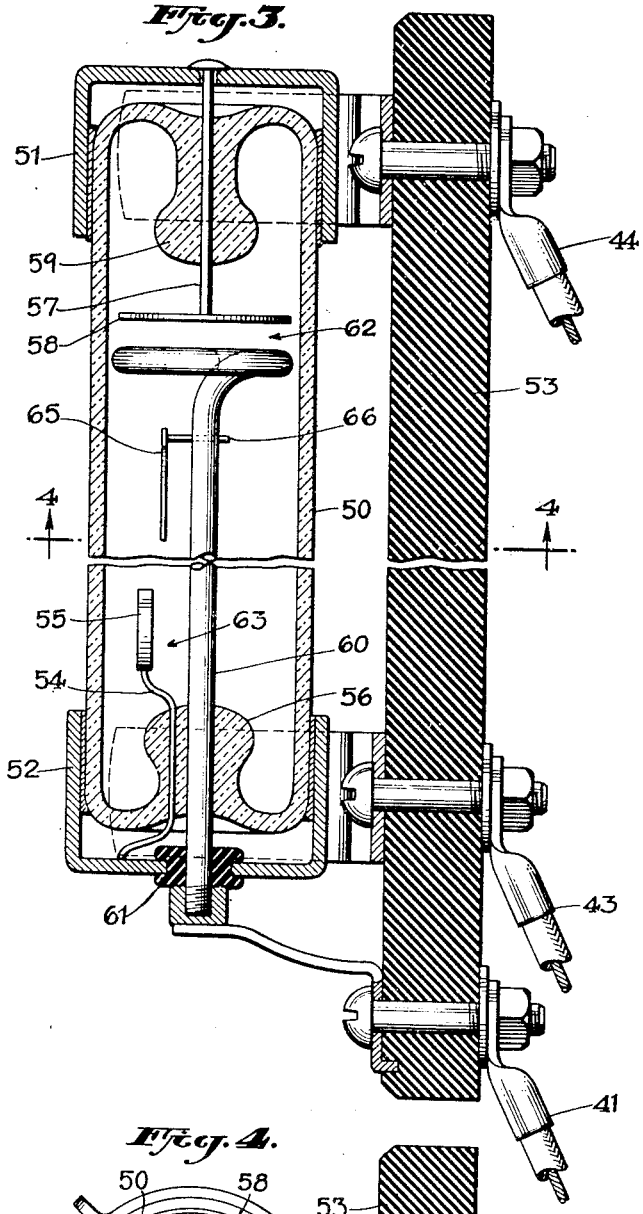


Fig. 5.

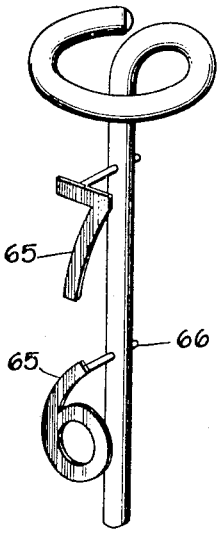
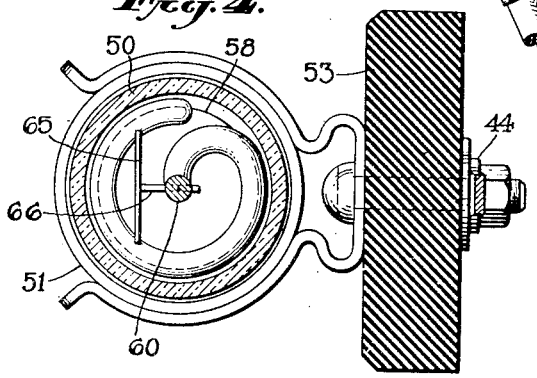


Fig. 4.



INVENTOR.
JOSEPH R. SCHOENBAUM.
BY L. Malcolm Oberlin
ATTORNEY

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ELEVATOR POSITION INDICATOR

Joseph R. Schoenbaum, Roseland, N. J., assignor to William Martin, Jr., doing business as Martin Elevator Company, New York, N. Y.

Application June 5, 1946, Serial No. 674,604

4 Claims. (Cl. 177—336)

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This invention relates to elevator systems and, more particularly, to position indicators for such systems.

It is a general object of the invention to improve the construction and operation of elevator systems and position indicators therefor.

It is a more specific object of the invention to provide a low cost indicator system which is readily installed, simple in construction and operation, and in which the parts are readily interchangeable.

It is a still more specific object of the invention to provide, first, an elevator system comprising a position indicator in which no moving parts are necessary and, second, a position detector having no wearing parts, thus eliminating difficulties heretofore experienced due to mechanical wear of the moving parts used in the indicators and position-detecting means.

It is a further object of the invention to provide an electrically-operated indicator system in which a minimum of conductors are utilized for connecting the position detecting means to the respective indicators.

It is a still further object of the invention to provide a position detecting device which is mechanically connected to a drum or other convenient part of the elevator drive mechanism, such detecting device producing a voltage which is dependent upon the position of the car in the shaft. An additional object is to utilize such voltage for energizing a plurality of visual indicators each comprising a gas-filled glow tube, one of which may be conveniently placed at each floor level or at any other suitable location, each glow tube having an illuminated character or series of characters for indicating the position of the car in the shaft.

Another object of the invention is to provide such an indicator in which the characters are illuminated in ascending order as the car rises in the shaft and in descending order as the car is lowered.

Various other objects, features and advantages of the invention will become apparent from the following detailed description taken in connection with the appended drawings, in which—

Figure 1 is a vertical, sectional view of an elevator system utilizing the novel position indicators;

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Fig. 2 is a front elevational view of an elevator position indicator having a suitable energizing circuit associated therewith;

Fig. 3 is a vertical sectional view of the indicator shown in Fig. 2;

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3; and

Fig. 5 is a fragmentary perspective view of an electrode and the characters supported thereby.

In accordance with the invention, a position detecting means P, which, in the example shown, includes a rotary transformer mechanically connected to the elevator drive mechanism, is utilized for providing a voltage which varies in accordance with the position of the elevator car in the shaft. The output voltage from the position detector is fed to a plurality of novel indicators I, one of which is preferably provided for each floor level or in other locations as desired. The preferred form of indicator comprises an elongated gas-filled glow tube which includes a number of characters, such as letters or numerals, which are illuminated in accordance with the position of the car in the shaft.

Referring to the drawings in detail and particularly to Fig. 1, the elevator system may comprise an elevator shaft 10 in which a car 11 is suspended. The car 11 is provided with the usual cable 12 to which is attached a counterweight 13 for partially balancing the weight of the car. The drive mechanism for the elevator system may include the cable 12 which is secured to the car as at 15, said drive cable passing over suitable pulleys 16 at the top of the shaft and thence downwardly to a drum 17 which may be mounted below the bottom floor of the building or at the top of the shaft depending on the type of installation. The drum is mounted on a shaft 18 which is driven, in any suitable manner, by a motor 19.

The position detecting means P comprises a rotary transformer 25 having a rotor 26 and a stator 27, Fig. 2. The rotor is mechanically connected to the drum shaft 18 or any other suitable moving part of the elevator drive mechanism as through reduction gearing 27a. In the embodiment of the invention shown in Fig. 2, the stator 27 comprises two sets of laminations or core members 28, 28 and 29, 29 which are off-

set at an angle of 90 degrees from each other. A pair of series-connected primary windings 30 are mounted on the laminations 28 and a pair of series-connected primary windings 31 are mounted on the laminations 29. The windings 30 are connected between an input terminal 32 of a suitable alternating current source and a stationary "up" contact of a double pole, double throw relay 34. The windings 31 are connected between the input terminal 32 and a stationary "down" contact of the relay 34. A movable relay contact 35, which is adapted to contact the "down" and "up" contacts previously described, is connected to the other terminal 38 of the alternating current source. It will be apparent that the windings 30 are energized when the relay contacts are in the "up" position while the windings 31 are energized when the relay contacts are in the "down" position. The relay 34 is connected to and usually forms a part of the conventional elevator control board, this relay being energized by a solenoid coil 39 to move the contacts to the "up" position as the car starts to rise in the shaft and to move the contacts to the "down" position when the car starts to descend.

A secondary winding 40 is mounted on the rotor 26, said winding being connected between an electrode conductor 41 of the indicator I and a movable contact 42 of the second set of contacts provided on relay 30. The stationary "up" and "down" contacts associated with movable contact 42 are connected by conductors 43 and 44, respectively, to electrodes of the indicator I in the manner hereinafter explained.

The rotor is preferably mechanically connected to the drive mechanism so as to rotate through an angle of approximately 90 degrees as the car moves from the bottom to the top of the shaft. With the car at the bottom of the shaft, the "up" contacts are closed and the longitudinal axis of the rotor is perpendicular to the axis of windings 30, as shown, with the result that the transformer operates at minimum efficiency, only a very small voltage being induced in the secondary winding 40 by the energized primary windings 30. As the car rises in the shaft, the rotor turns to thereby increase the coupling between the windings 30 and 40, thus raising the output voltage of the transformer. As the car reaches the top of the shaft, the maximum output voltage is developed and the longitudinal axis of the rotor coincides with the axis of the windings 30. Subsequently, when the car descends, the relay contacts move to "down" position, de-energizing primary windings 30 and energizing primary windings 31. In this manner, the output voltage again falls to a minimum since minimum coupling is provided between the windings 31 and 40 with the rotor in the last described position. As the car descends, the rotor returns toward its original position, thus increasing the coupling between windings 31 and 40 and raising the output voltage of the transformer, the maximum voltage being reached when the car returns to the bottom of the shaft. Consequently, as the car moves from one end of the shaft to the other in either direction, the output voltage of the transformer has a minimum value when the car is in its initial position at one end of the shaft which rises to a maximum value as the car moves toward the other end of the shaft. It will also be apparent that the output voltage is proportional to the distance of the car from the bottom of the shaft when the car is moving upwardly and that said output voltage is proportional to the distance of the car from the top of the shaft when its is moving downwardly.

The output voltage, in accordance with the invention, is used to actuate one or more position indicators I which show the position of the car in the shaft and the direction in which the car is moving. The indicator, which is best shown in Figs. 2 and 3, comprises an elongated glow tube 50 which is filled with an inert gas or combination of gases such, for example, as neon or argon. The tube is mounted between top and bottom metal brackets 51 and 52, respectively, which, in turn, are secured in any suitable manner to a panel or support 53. A rod 54 carrying an interior electrode 55 extends through a seal 56 at the bottom of the tube and this rod is suitably secured to the bracket 52 which is electrically connected to the conductor 43. In similar fashion, a rod 57 carrying an interior electrode 58 extends through a seal 59 at the top of the tube and said rod 57 is secured to the bracket 51 which is electrically connected to the conductor 44.

An indicator electrode or conductor rod 60 is mounted on the bracket 52 and insulated therefrom as by an insulating washer 61. From the bracket 52, the indicator electrode extends through the seal 56 and thence axially through the tube to the top thereof where it is shaped to form a circular segmental portion which, together with the electrode 58, defines a top discharge gap 62. The lower portion of the indicator rod and the electrode 55 define a bottom discharge gap 63. The electrode 60 is connected, in any suitable manner, to the conductor 41 so that, when the relay 34 is in the "up" position, the output voltage of the transformer 25 is impressed across the lower discharge gap 63 and, when the relay is in the "down" position, the output voltage is impressed across the upper discharge gap 62.

In order to indicate the position of the car in the shaft, a series of characters 65 are provided which may be of any suitable type, as letters, numerals or otherwise, as desired, so as to indicate the various levels or sublevels of the building. Each character may be formed of conducting material if, in a particular application, it is desired that the characters glow in indication of the car position; further said characters may be coated with an activatable material such as is known to the art as a fluorescent substance, to provide an increase in luminous intensity; further said characters may be made of non-conducting material if, in a particular application, it is desired that the characters be outlined or silhouetted against a glowing portion of the tube. The support 66 may conventiently extend through or be welded to the rod 60 in order to properly support and position the character within the glow tube.

The operation is as follows: Assuming that the car is at the bottom of the shaft and the contacts of relay 34 are in the "up" position, a small voltage is applied to the lower discharge gap 63 causing the gas in the lower portion of the tube to become luminescent. As the car rises, the voltage applied to the gap 63 increases with resultant increase in the length of the glowing portion of the tube. When the car reaches the top of the shaft, the maximum voltage is applied and the tube is completely luminescent. As the top of the glowing column of gas successively reaches the ends of the suports 66 on characters

65, the gas surrounding said characters becomes luminous to thereby indicate the position of the car. The transformer windings and character arrangement are so adjusted that the characters become luminous in ascending order as the car reaches the corresponding floor levels indicated thereby.

When the car reaches the top of the shaft, the contacts of relay 34 move to the "down" position, thus deenergizing the lower discharge gap 63 and applying a small voltage across upper discharge gap 62. As a result, the gas within the tube ceases to glow except for a small portion at the top of the tube adjacent the upper discharge gap 62. As the car descends, the voltage impressed upon the gap 62 increases with the result that end of the glowing column of gas moves downwardly, thus illuminating the characters 65 in descending order until the car reaches the bottom of the shaft. Thereupon, the relay 34 again moves to the "up" position in readiness for another cycle of operation. It will be understood that the indicator functions properly when the car changes direction at an intermediate floor level since the relay 34 operates whenever the car changes direction and the output voltage of the transformer is dependent upon the position of the car in the shaft.

In Figure 1, a separate indicator is shown at each floor level. It will be understood that the corresponding electrodes for each indicator may be connected in parallel as by a cable 70, the output of the transformer being ample to energize any desired number of indicators. In this manner, the three-wire cable 70 is the only connection required between the indicators which is a considerably simpler arrangement than provided by indicating systems previously known. Moreover, indicators may be placed in any position desired and even in positions quite remote from the elevator without the necessity for providing bulky and expensive mechanical connections therefor.

The present system has been found to be extremely reliable in operation and ready interchangeability of parts is possible since an indicator may be removed simply by physically removing the tube from its supporting brackets. It will also be apparent that a completely electrical system is provided with no mechanical parts to wear out on the indicators.

Although the invention has been described in connection with a present preferred embodiment, it will be understood that various changes and modifications may be made without departing from the spirit and scope of the invention. Thus, the tube may be surrounded by a sleeve having cutout portions to represent the characters indicating the floor levels, these cutout portions being illuminated when the gas is glowing in the adjacent portions of the tube. Also the tube may be curved or otherwise formed to suit a particular design. Hence, it will be apparent that the form of characters shown is merely illustrative and other constructions may be used to furnish the visual floor-level indication. It is also within the scope of the invention to utilize a tube having only a single pair of electrodes which are energized by a voltage proportional to the height of the elevator in the shaft. In such a modification, the height of the glowing gas column indicates the position of the car in the shaft at all times although it is not possible to determine whether the car is ascending or descending when it is stationary in the shaft. All the above modifications together with others

which may occur to those skilled in the art are intended to be covered in the appended claims.

The invention as hereinbefore described referred to a rotary transformer for producing the variable voltage. It shall be understood, however, that the invention is not to be thus limited. Thus, for example, there may be utilized any other variable voltage source such as a transformer having a slidable structure rather than a rotor as hereinbefore described.

While the invention has been described with respect to a certain particular preferred example which gives satisfactory results, it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. In an elevator system, in combination, a car in an elevator shaft, a drive mechanism including a rotatable member for raising and lowering the car in said shaft, a rotary transformer having a rotor and a stator, said rotor being mechanically coupled to said rotatable member whereby the transformer output voltage is dependent upon the position of the car in the shaft, and an elevator position indicator comprising an elongated gas-filled glow tube, an electrode structure defining a discharge gap at each end of the tube, means for applying said output voltage across one of said discharge gaps to cause the gas within the adjacent portion of the tube to glow, the length of the glowing portion depending upon the magnitude of said voltage, and a plurality of indicators spaced along the tube, each indicator registering when the gas in the adjacent portion of the tube is luminescent.

2. In an elevator system, in combination, a car in an elevator shaft, variable transformer means for producing a voltage which is dependent upon the position of the car in said shaft, an elevator position indicator comprising an elongated gas-filled tube, an electrode structure defining a discharge gap at each end of the tube, means for applying said transformer output voltage to one discharge gap while the elevator is ascending and to the other discharge gap while the elevator is descending, and indicating means responsive to the energization of said discharge gaps, said indicators showing the position of the car and whether it is ascending or descending.

3. In an elevator system, in combination, an elevator shaft, an elevator car therein, a drive mechanism for raising and lowering the car in said shaft, a current source, an electrical translating device connected to said current source and actuated by said drive mechanism for producing a first voltage proportional to the distance of the car from the bottom of the shaft and a second voltage proportional to the distance of the car from the top of the shaft, an elongated glow tube having two sets of electrodes, one adjacent each end thereof, a circuit for impressing said first voltage on one set of electrodes, a circuit for impressing said second voltage on the other set of electrodes, means for selectively energizing said circuits responsive to the direction of movement of the car in the shaft, and indicating means responsive to the energization of said electrodes, said indicators showing the position of the car and whether it is ascending or descending.

4. In an elevator system, in combination, an

elevator shaft, an elevator car therein, a drive mechanism including a rotatable member for raising and lowering the car in the shaft, an electrical transformer having a rotor element mechanically coupled to said rotatable member and a stator element, one of said elements having two windings thereon defining an angle of 90 degrees therebetween, a current source for energizing said transformer, an elongated glow tube having two sets of electrodes, one adjacent each end thereof, a pair of circuits connecting said windings with the respective sets of electrodes, means for selectively energizing said circuits responsive to the direction of movement of the car in the shaft, and indicating means responsive to the energization of said electrodes, said indicators showing the position of the car and whether it is ascending or descending.

JOSEPH R. SCHOENBAUM.

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