

PATENT SPECIFICATION

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(54) ELEVATOR CONTROL SYSTEM

(71) We, MITSUBISHI DENKI KABUSHIKI KAISHA, a Japanese Company, of 2-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an elevator control system.

A recent technical trend of elevator control systems is a change from control using mechanical components to that using electric and electronic components due to various factors; development of electronics, lengthened travelling distance of elevator cars, speed-up of elevator travelling, high-level demands of passengers, and the like.

In elevator control systems, a basic operation is that, when a call is registered, a car moves in response to the registered call to satisfy the demand of the call. In order to improve the service, however, consideration is given to the facility that, even after the car starts to move, it answers a call issued from a floor at which it is permitted to stop for service. For this, the elevator control must calculate the position or floor at which the travelling car may stop in relation to its travelling speed, by some method. In conventional control systems with mechanical type floor selectors, the car stop is decided by using a selector (to indicate the car position) moving in synchronism with the travel of the car and an advance selector (to indicate the position where the car may stop) moving proportionally to the travel of the car. However, the mechanical type control system can hardly exert its proper control in high-speed and high-rise elevator systems, due to the limitation of finishing accuracy, diminishing scale, and the like. This has resulted in the development of the electric floor selector. To facilitate the understanding of the invention reference will now be made to Figures 1 and 2 of the accompanying drawings of which:—

Figure 1 is a block schematic drawing of an elevator control system using an electric floor selector not embodying the present invention;

Figure 2 is a block schematic diagram of the major part of the Figure 1 arrangement.

Referring to Figure 1, an elevator car 1 is supported by a hoisting rope 4 extending up over a traction sheave 3 provided around the shaft of a drive motor 2. 5 is a counterweight connected to the other end of the rope 4. 6 is a looped speed governor rope connected at one end to the top of the car 1 and at the other end to the bottom of the car 1. The speed governor rope is wound around a governor sheave 7 disposed over the top of the car 1 running in the hoistway and a pulley 8 disposed at the bottom of the hoistway. 9 is a pulse generator for pulses corresponding to the amount of the travel of the car 1 coupled with the governor-sheave 7, and generates one pulse each unitary movement (for example, 5 mm, 10 mm) of the cage 1. 10 designates respective floors and 1st to *n*th floors represented by 1F to *n*F. 11 designates a device indicating the levelling zone. Each floor is provided with one identical device of the levelling zone indication. A detecting device 12 provided on the car 1 permits one to know that the car 1 enters the levelling zone. 13 designates an electric floor selector. 13a is a car position arithmetic unit which counts the number of pulses fed from the pulse generator 9 when the car 1 goes up, with reference to the floor 1F. Through the counting operation, it indicates the position in the hoistway where the car 1 passes with respect to the reference point 1F. 13b denotes a floor position memory for permanently memorizing the positions of respective floors in terms of the distance from the reference point 1F. By addressing one of the floors 1F to *n*F, it produces the distance from the reference point corresponding to the floor addressed.

13c is a stop permissible position arithmetic device in which the stop permissible position of the running car 1 is

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calculated on the basis of the position information fed from the pulse generator 9, the speed information (not shown) of the car 1 and the like. 13d is a comparator in which the output of the floor position memory 13b and the output of the stop permissible position arithmetic unit 13c are compared to produce a large or small magnitude output as a result of the comparison in accordance with the travelling direction of the car 1. 13e is a stop permissible floor indicator which increases or decreases by one each time the output of the comparator 13d is given thereto to produce an output indicating the stop permissible floor. 13f represents a stop decision arithmetic unit which receives at the input a call corresponding to the stop permissible floor fed from the stop permissible floor indicator 13e and produces a stop decision signal when there is a responsible call. 13g represents a remaining distance arithmetic unit in which, when the stop of the car 1 is decided, a difference is calculated between the distance of the floor at which the stop is decided from the reference point and the distance of the car 1 present position from the reference point to produce the remaining distance by which the car 1 must travel until it stops. This distance is applied to a speed pattern generator (not shown).

Assume now that the car 1 stops at the floor 1F (used as the reference floor), and at this time the car position in unit 13a is zero and the stop permissible floor indicator 13e indicates 1F. Under this condition, the car 1 starts to move in response to generation of a call from an upper floor. With movement of the car 1, the speed governor sheave 7 starts to rotate and the pulse generator 9 generates the number of pulses corresponding to the amount of the car 1 movement. The pulses are fed to the car position arithmetic unit 13a and the stop permissible position arithmetic unit 13c where necessary calculations are performed. The stop permissible floor indicator 13e indicates 2F to which a unit is automatically added by an up-direction start signal (not shown) of the car 1. The floor position memory 13b applies the distance from the reference point to the floor 2F, addressing 2F. The comparator 13d compares the output of the floor position memory 13b (the 2F address) with the output of the stop permissible position arithmetic unit 13c. When the output of the stop permissible position arithmetic unit 13c is larger, the comparator 13d produces a large signal which adds one unit to the contents of the stop permissible floor indicator 13e. With the addition of one unit the indicator produced 3F while the floor position memory 13b produces an output

with the address of 3F. In this manner, the output of the stop permissible floor indicator 13e changes. On the other hand, the stop decision arithmetic unit 13f constantly seeks a call to be responded to the stop floor indicated by the stop permissible indicator 13e. If a call is now generated from the floor 4F, the stop decision arithmetic unit 13f issues a stop decision signal to be directed to the stop permissible position arithmetic unit 13c thereby to stop its operation. After this, the comparator 13d does not operate and the output of the stop permissible floor indicator 13e indicates the floor at which the car 1 will stop. Further, the stop decision signal is given to the remaining distance arithmetic unit 13g which in turn produces the difference between the position of the car 1 in the hoistway and the position by the floor position memory 13b, as the remaining distance to be travelled by the car 1.

When the levelling zone indicating device 11 and the detecting device 12 cooperate to detect that the car enters the levelling zone, a levelling device (not shown) separately provided generally causes the car 1 to be levelled with the floor level when it stops. When the car 1 stops, the output of the floor position memory 13b with the stop floor address of the output of the stop permissible floor indicator 13e is applied to the car position arithmetic unit 13a and the stop permissible position arithmetic unit 13c to set up the initial conditions of the units 13a and 13c. In response to a new call, calculation is performed on the basis of the initial condition and the stop is repeated in response to the call.

No problem arises provided the equipment operates correctly. However, when the slip takes place, for example, between the speed governor rope 6 and the speed governor sheave 7 and the amount of the slippage exceeds one floor, the floor at which the car actually stops is not coincident with the stop floor indicated by the stop permissible floor indicator 13e, resulting in trouble in the elevator service. One of the countermeasures for this is that, as shown in Figure 2, floor identifying units 14-1F to 14-nF each for identifying the corresponding floor are installed at the floors, respectively. A stop floor identifying indicator 13h receiving as its input the output of a floor name detecting unit 15 is attached to the car 1 and the stop permissible indicator 13e is corrected each time the car 1 stops.

With this arrangement, each floor needs a floor identifying unit 14-1F to 14-nF for indicating the name of the corresponding floor. Accordingly, when the number of the floors is large, manufacturing of individual

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floor identifying units and fitting thereof involves much labour and the floor name detecting unit 15 is complex in construction, thus being disadvantageous from the economical view point.

The present invention seeks to provide an improvement which alleviates the above-mentioned disadvantages. More specifically, an object of the present invention is to provide an elevator control system using an electric floor selector with a relatively simple construction in which, when an erroneous operation occurs, may be quickly corrected.

According to one aspect of the present invention, there is provided an elevator control system including an electric floor selector and comprising: a specific floor unit provided at least one specific floor in the hoistway and indicating the or each specific floor specifically; non-specific floor units provided at the other floors than the or each specific floor and for indicating the floor non-specifically; detecting means provided on a car for detecting both specific floor units and non-specific floor units and for generating signals corresponding thereto; a floor indicator for indicating the floor at which the car actually stops by using the signal from the detecting means; and a stop permissible floor indicator for indicating, by electrical calculation, the floor at which the car stops, there being a comparator in which comparison is made of the output of said floor indicator with the output of said stop permissible floor indicator; when these outputs are different, the car is moved to the or a specific floor and, when the car stops at the specific floor, said floor indicator and said stop permissible floor indicator are set to said specific floor. With such an arrangement, comparison is made of the output of the floor indicator with the output of the stop permissible floor indicator. In the comparison, when these outputs are different, the car is moved to the specific floor. When the car stops at the specific floor, the floor indicator and the stop permissible floor indicator are set to the specific floor.

Preferably a plurality of specific floors are used. Calculation is made of the distances between the floor indicated by the stop permissible indicator or the floor indicated by the floor indicator and the specific floors. The car is moved toward the specific floor with the shortest distance. The invention will further be described with reference to Figures 3 and 4 of the accompanying drawings of which:—

Figure 3 shows, by way of block and schematic diagram, an elevator control system according to the present invention; and

Figure 4 (a) and (b) cooperate to form a detailed circuit diagram of the arrangement of Figure 3.

In the drawings, like reference symbols are used to indicate like or equivalent portions.

Referring now to Figure 3, there is provided a unit 14 denoting a specific floor of 1F, with the floor 1F as the specific floor. The floors other than 1F are provided with only floor denoting units 16, respectively. The car 1 is provided with a detecting unit 15 which may detect the presence of the specific floor denoting unit 14 and the floor denoting units 16 on being aligned therewith. The unit 15 produces signals indicating the alignment on signal lines 15a and 15b. More particularly, a signal indicating the alignment of the detecting unit 15 with the specific floor denoting unit 14 appears on the signal line 15a. A signal indicating the confrontation of the detecting unit 15 with the floor denoting unit 16 appears on the signal line 15b. These signals on the lines are fed to the electric floor selector 13. 13i is representative of a floor indicator indicating the floor at which the car 1 is positioned. The floor indicator is set to the specific floor by the signal on the signal line 15a and then increases or decreases the floor by one each time the signal appears on the signal line 15b in accordance with the moving direction of the car 1. In this manner, it indicates the floor at which the car 1 is positioned. When the car 1 stops, a comparator 13j compares the output signal (indicating the floor at which the car 1 is positioned) of the floor indicator 13i with the output (indicating the floor at which the car 1 supposedly stops when it has stopped) of the stop permissible floor indicator 13e. When these outputs are different in the comparing operation, the comparator provides a signal for moving the car 1 toward the specific floor (1F in the figure) to a control unit (not shown) so that it causes the car 1 to travel toward the specific floor. The travelling of the car is stopped by the signal from the specific floor and at the same time the floor indicator 13i and the stop permissible floor indicator 13e are set at the specific floor. Thus, if for some reason the stop permissible floor indicator 13e or the floor indicator 13i goes wrong, the car 1 is moved to the specific floor to permit the trouble to be remedied.

In the description thus far made, floor denoting units 16 additional to the units 11 were described for ease of explanation. However, it is possible to use the levelling zone denoting units 11 as the non-specific floor units, so that the additional floor denoting unit 16 may be omitted. Further, if the detected signal obtained from the levelling zone detecting unit 12 in place of

the detecting unit 15 is used as the floor signal, it is possible to use only the specific floor for the object to be detected by the detecting unit 15.

In the above explanation, the first floor was used for the specific floor. However, a plurality of floors may be designated as specific floors. Thus, the time taken for the car to reach the specific floor may be shortened, particularly if there is a large number of floors. In this case, an arrangement may be possible in which the distances between the floor indicated by the floor indicator 13i or the stop permissible indicator 13e and the specific floors are calculated and the car is moved to the nearest specific floor on the basis of the result of the calculation.

For a better understanding of the present invention, a further detailed description will be given with reference to Figures 4a and b illustrating the circuit diagram of the electric floor selector 13 shown in Figures 1 and 3. In Figures 4a and b, the signals travelling between the Figures (a) and (b) are put in parenthesis. For example, (A>B) in Figure 4 indicates the signal going from (a) to (b) or fed from (b) to (a), the direction of the signal travelling depending on the arrow of the signal. Other signals are those fed to respective related units (not shown) or fed from them. In the figure, the functional components are designated by blocks with symbols (e.g. B4) on the left hand shoulders, respectively. Gate circuits and related circuits are indicated by numerals in the functional blocks.

In Figures 4(a) and (b), A1 designates a monostable multivibrator which produces a pulse with a fixed pulse width at the fall time of an input pulse and may use, for example, SN74123 manufactured by Texas Instrument Co. (abbreviated as TI). B1, B2, B3, B4, B5, and B6 are synchronous UP/DOWN presetable 4-bit binary counters and may be of type SN74193 by TI, for example. C1 to C4 are 4-bit magnitude comparators each of which has groups of input terminals, A1 to A4 and B1 to B4, and three output terminals. A>B, A=B, and A<B. The comparator compares two of four bit inputs and applies the result of the comparison from the corresponding output terminal. SN7485 by TI, for example, may be used. D1, D2 and D3 are quadruple D-type flip-flops in which an input signal is applied at the fall time of a timing signal and the contents applied are derived from the output terminals. SN74175 by TI, for example, may be used for the flip-flop. M1 is representative of a 256(32×8) bits programmable read only memory which has addresses each consisting of 5 bits and output signals each consisting of 8 bits are derived from the corresponding addresses.

One of the memories commercially available is IM5600 manufactured by Intersil Co. S1 and S2 are 4-bit binary full adders for adding two groups of 4-bit binaries, with input and output carries. SN7483 manufactured by TI is commercially available and suitable for the full adder.

The explanation to follow will be made with an assumption that the amount of movement at acceleration is equal to that required for deceleration, for ease of explanation. In Figure 4(a), the portion comprising A1, B1, B2, D1 and D2, AND gates 1 and 2, and an OR gate 13 corresponds to the stop permissible position arithmetic unit 13c shown in Figure 1. As described above, since the amount of movement at acceleration is equal to that at deceleration, the stop permissible position may be calculated at any time by doubling the amount of movement at acceleration. PP designates a pulse signal indicating the amount of movement fed from the pulse generator 9 which is applied directly to the OR gate 13 and the monostable multivibrator A1 which produces a pulse with a fixed width at the fall time of the applied pulse and the generated pulse is fed to the OR gate 13. The time delay of the monostable multivibrator A1 enables the OR gate 13 to produce two pulses in response to one pulse PP. Signals ① and ② are fed from a control circuit (not shown) and include the information of the movement directions; the signal ① indicates the up-direction and the signal ② the down direction. (STOP) shows a stop decision signal to be described later.

When the elevator car starts to travel, AND gate 1 or 2 is enabled in accordance with the travelling direction. The output of the OR gate 13 passes through the AND gates 1 or 2 to reach the count-up terminal or the count-down terminal of the binary counter B1. This condition continues until the stop decision signal (STOP) disables the AND gate 1 or 2. The binary counters B1 and B2 constitute a 8-bit binary counter in which the carry of the binary counter B1 is connected to the up-input of the binary counter B2 while the borrow of the counter B1 is connected to the down-input of the counter B2. The contents of the counter comprising the binary counters B1 and B2 is increased or decreased by the pulse signal PP to indicate the stop permissible position. The input terminals A, B, C and D of the binary counters B1 and B2 are input terminals for receiving the preset inputs. Through this connection, the position of the car 1 at the start is fed to the binary counters B1 and B2. A loading signal LOAD 1 is fed from the

control circuit (not shown) immediately before it starts. The input signals to the input terminals A to D of the binary counters B1 and B2 are all fed from the floor position memory M1 to be described later. The outputs Q_A to Q_D of the binary counters B1 and B2 are fed to the flip-flops D1 and D2 and timing signals to the flip-flops D1 and D2 are repeatedly generated with proper timing from the control circuit (not shown). The timing signal designated by T permits these outputs to go into the flip-flops D1 and D2. As shown, the output Q_A of the binary counter B1 is fed to the input 1D of the flip-flop D1 and the output Q_D to the 4D. The Q_A of the B2 is coupled with the 1D of the D2 and the Q_D with the 4D. In this way, the outputs of the binary counters B1 and B2 are held in the flip-flops D1 and D2 through the timing signal T to ensure the signal procession at the comparison.

The portion comprised of the binary counters B3 and B4 and AND gates 3 and 4 corresponds to the car position arithmetic unit 13a in Figure 1. The operation of this circuit is the same as of the stop permissible position arithmetic unit 13c, except for the monostable multivibrator A1 and the OR gate 13. In the other words, the doubled movement quantity is used for the calculation in the stop permissible position arithmetic unit 13c while the movement quantity not doubled is used for the same in the car position arithmetic unit 13a. As previously described, just before the start, the stop position of the car 1 is fed to the parallel inputs A, B, C and D of the binary counters B3 and B4. In accordance with the movement direction, the contents of the binary counters B1 and B2 are increased or decreased on each reception of the pulse signal PP. In other words, the contents of the binary counters always indicates the position of the car 1, in the hoistway.

The portion comprised of the read only memory M1 corresponds to the floor position memory 13b in Figure 1. In this memory, the outputs of the memory corresponding to address inputs A1 to A5 are previously stored. The addresses A1 to A5 correspond to the floors. The outputs of the memory when it is addressed indicate the distances from the bottom of the hoistway, respectively. More precisely, if the car 1 now stops at the 5th floor, the address 5 is converted into a binary code and then is applied to the memory M1. At this time, the memory M1 produces an output indicating the distance of the 5th floor from the bottom of the hoistway and provides the position of the car when it starts from the 5th floor to the binary counters B1 to B4 and like.

The portion comprised of the full adders

S1 and S2, exclusive OR gates 20 to 5 correspond to the remaining distance arithmetic unit 13g in Figure 1. The remaining distance arithmetic unit 13g executes a binary subtraction between the output of the read only memory M1 and the outputs of the binary counters B1 and B2. More particularly, when the car 1 goes up, the outputs of the binary B1 and B2 are subtracted from the output of the memory M1. When the car 1 goes down, the output of the M1 is subtracted from the outputs of the counters B1 and B2. When the stop is decided, calculation is made of the remaining distance that the car 1 must travel until it will stop. Thus, the calculated remaining distance is applied as distance information to the deceleration pattern generator (not shown). Generally, in the binary subtraction, the complementary of 2 of divisor and dividend are binary added and 1 is added to the result. Thus, binary subtraction is realized by using exclusive OR gates for obtaining the complementary of 2 binary adders.

When the car 1 is travelling in the up direction, the directional signal $\odot$ is logical "1" and applied to exclusive OR gates 20, 22, 24, 26, 28, 30, 32 and 34. At this time, the output Q_A of the binary counter B3 is applied to the exclusive OR gate 20, the Q_B to the gate 22, the Q_C to the gate 24, the Q_D to the gate 26, and the output Q_A of the binary counter B4 is applied to the exclusive OR gate 28, the Q_B to the gate 30, the Q_C to the gate 32, and the Q_D to the gate 34. Therefore, the inverse output of the output Q_A of the binary counter B3 appears at the output of the exclusive OR gate 20. The inverse output of the Q_B of the gate 22 appears at the output of the gate 22. This is correspondingly applied to the outputs of other gates 24, 26, 28, 30, 32, and 34. That is, the complementary of the outputs of the binary counters B3 and B4 are obtained at the outputs of the exclusive OR gates. Under this condition, the directional signal $\odot$ is logical "0" and therefore the outputs D1 to D8 of the memory M1 coupled with the exclusive OR gates 21, 23, 25, 27, 29, 31, 33 and 35 are not reversed. The output D1 of the memory M1 appears at the output of the gate 21 and the output D2 appears at the output of the gate 23. Likewise, the outputs D3 to D8 are produced at the outputs of the gates 23, 25, 27, 29, 31, 33 and 35, respectively. As shown, the exclusive OR gates 20, 22, 24 and 26 are coupled with input terminals A1, A2, A3 and A4 of the full adder S2. The outputs of the exclusive OR gates 21, 23, 25, and 27 are coupled with the inputs B1, B2, B3 and B4 of the full adder S1. The carry input C1 of the full adder S1 is connected to the power source Vcc for giving logical "1". The carry output

Co of the same is connected to the carry input C1 of the adder S2. Similar circuit connection is applied to the full adder S2 except that the carry input C1 is fed from the carry output Co of the adder S1. In this way, when the car travels up, the remaining distance is calculated by subtracting the outputs of the binary counters B3 and B4 from the output of the memory M1.

Reference symbols C1 and C2 correspond to the comparator 13d shown in Figure 1. The C1 and C2 cooperate to constitute an 8-bit magnitude comparator. As shown, the outputs 1Q to 4Q of the flip-flops D1 and D2, i.e. the outputs of the stop permissible position arithmetic unit, are applied to the input terminals A1 to A4 of the comparators C1 and C2. The outputs D1 to D8 of the memory M1 are applied to the input terminals B1 to B4 of the comparator. The contents of the A1 to A4 and of the B1 to B4 are binary-compared and if the former is larger than the latter, the comparator produces an output of $A > B$; if they are equal to each other, it produces $A = B$; if the former is less than the latter, it produces $A < B$.

The portion comprised of a counter B5, AND gates 5, 6, 7 and 8, and OR gates 12 and 13 corresponds to the stop permissible floor indicator 13e shown in Figure 1. Signals designated by ① and ② are the directional signals. ($A > B$) and ($A < B$) are the outputs ($A > B$) and ($A < B$) of the comparator C2. A signal T2 is generated to increase or decrease by 1 the contents of the counter B5 after the loading signal LOAD 1 is fed in the control circuit (not shown). The explanation will be given for the case when the car travels upwardly. In this case, an AND gate 7 is enabled to permit the signal T2 to go through an OR gate 12 to the up-input terminal of the counter B5, resulting in an increase of 1 of the counter B5 contents. The outputs Q_A, Q_B, Q_C and Q_D of the counter B5 are applied to the addresses A1 to A4 of the memory M1 in the forms of signals Q_A, Q_B, Q_C and Q_D. The contents of the counter B5 increases by one at the start. That is, at this time, the output of the memory M1 corresponding to the floor and the outputs of the binary counters B1 and B2 are compared, resulting in production of the output of $A < B$. With travelling of the car 1, at the instant when the output of the memory M1 is smaller than the outputs of the binary counter B1 and B2, the output of $A > B$ is fed from the comparator C2 to the AND gate 5. So far as the stop is not decided, the signal of $A > B$ is applied through the OR gate 12 to the up-input of the counter B5 so that the contents of the counter B5 is increased by 1. The increase of 1 in the contents of the counter B5 makes the output of the memory M1 change. As a

result of this, the comparators C1 and C2 produce an output of $A < B$. This will be repeated until the stop decision signal STOP is generated. This means that the car 1 starts to travel and the counter B5 indicates the next floor at which the car is to be stopped.

In the case of the car travelling downwardly, the signal is applied to the down-input of the counter B5 through AND gates 6 and 8, and OR gate 13. The signal $A < B$ is used for the output of the comparator C2. The inputs A, B, C and D of the binary counter B5 are provided so as to set the specific floor in the counter B5 when the car stops at the specific floor. The timing of loading it into the counter B5 is such that it is loaded into the counter B5 in response to the signal of 15a from the detector of the car 1 when the car 1 levels with the specific floor. In the figure, the 1st floor is assigned for the specific floor, and only the input A is connected with the power source Vcc for giving the logical "1" and others B, C and D are grounded for giving logical "0".

The portion including a comparator C3, NAND gates 14, 15, 16 and 17, and a call hold D3 corresponds to the stop decision arithmetic unit 13f shown in Figure 1. The outputs A1 to A4 of the comparator C3 are connected to the output of the counter B5 and the inputs B1 to B4 are connected with the outputs 1Q to 4Q of the call hold circuit D3. A binary call fed from a call circuit (not shown) is loaded into the call hold circuit D3 in response to a timing signal T3 and held therein. The timing signal T3 is generated from the call circuit. When both the inputs A1 to A4 and B1 to B4 are equal in the comparator C3, i.e. a call is generated from the stop permissible floor, the comparator produces the signal $A = B$. Under this condition, when the comparator C2 produces the signal $A = B$, the output of a NAND gate 16 becomes logical "0". As a result, the flip-flop circuit comprised of NAND gates 14 and 15 is in the set state and the STOP signal is logical "0" to the stop the input signals to the up-and down-inputs of the binary counters B1, B2 and B5. The above mentioned flip-flop is reset through a NAND gate 17 by the timing signal T2 fed just before the start.

The detailed circuit diagram of Figure 3 has been described. In actuality, calculation is performed on the basis of the pulse signal representing the movement quantity resulting from the movement of the car 1. There is a chance that something may cause the arithmetic units to operate erroneously and, as a result, the floor at which the car actually stops is different from the desired one. In such a case, it is necessary to detect the floor difference.

The circuit section defined by a 130

comparator C4, a counter B6, AND gates 9, 10 and 11 substantially indicates the comparator 13j and the floor indicator 13j.

A signal 15b is a pulse signal generated each time the car 1 levels with the floor, as mentioned above. The signal is fed to the up-input of the counter B6 by way of the AND gate 9 when the car travels in the up direction, while it is fed to the down-input of the counter B6 by way of the AND gate 10 in the travelling in the down direction. A signal 15a is the one obtained when the car 1 levels with the specific floor, and is used as a loading signal for loading a signal into the counter B6. In the figure, the loading is made in a condition that only the A input of the counter B6 is logical "1" while the others B, C and D are logical "0". This means that the specific floor is assigned for the 1st floor. When the car starts to travel from the 1st floor upwardly, the contents of the counter B6 is increased by one each time the car levels with the floor and, in a normal operation, the counter B6 indicates the position of the car 1 travelling up in terms of the floor. When the car 1 stops, the comparator C4 compares the contents of the counter B6 with that of the counter B5. At this time, if the contents are equal, the elevator system operates with an assumption that the calculations of the counters B5 and B6 are correct. If they are not equal, it is decided that something has caused the counters to operate erroneously. With such a decision, the car 1 is moved to the specific floor and a command to correct the erroneous operation is given to the control circuit (not shown). The control of an AND gate 11 with the output of A=B of the comparator C4 as a command to move the car to the specific floor and to be fed via the AND gate 11, is made by a signal FN for indicating being in stop which is fed from the control circuit (not shown). At the time that the signal FN enables the AND gate 11, if the output of the comparator is A=B and logical "1", the signal of "1" is fed to the control circuit (not shown), thereby permitting the operation to continue. At this time, if the output is logical "0", i.e. A≠B, the signal is the one for indicating the movement of the car to the specific floor.

As described above, the output of the floor indicator representing the floor at which the car actually stops and the output of the stop permissible floor indicator representing the electrically calculated stop floor when the car stops, are compared. In the comparison, when these outputs are

different, the car is moved to the specific floor and, at the specific floor, the floor indicator and the stop permissible floor indicator are set to the specific floor. With such an arrangement, even if slip takes place between the speed regulator rope and the speed regulator sheave and therefore the floor at which the car actually stops is different from the floor indicated by the stop permissible floor indicator, the correction of it may be quickly made, thus ensuring normal elevator service.

WHAT WE CLAIM IS:—

1. An elevator control system including an electric floor selector and comprising: a specific floor unit provided at at least one specific floor in the hoistway and indicating the or each specific floor specifically; non-specific floor units provided at the other floors than the or each specific floor and for indicating the floor non-specifically; detecting means provided on a car for detecting both specific floor units and non-specific floor units and for generating signals corresponding thereto; a floor indicator for indicating the floor at which the car actually stops by using the signal from the detecting means; and a stop permissible floor indicator for indicating, by electrical calculation, the floor at which the car stops, there being a comparator in which comparison is made of the output of said floor indicator with the output of said stop permissible floor indicator; when these outputs are different, the car is moved to the or a specific floor and, when the car stops at the specific floor, said floor indicator and said stop permissible floor indicator are set to said specific floor.
2. An elevator control system including an electric floor selector according to Claim 1, in which a plurality of specific floors are used; a calculation is made of the distances between the floor indicated by said stop permissible indicator or the floor indicated by said floor indicator and the specific floors; and the car is moved toward the nearest specific floor.
3. An elevator control system substantially as hereinbefore described with reference to Figures 3 and 4 of the accompanying drawings.

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comparator C4, a counter B6, AND gates 9, 10 and 11 substantially indicates the comparator 13j and the floor indicator 13j.

5 A signal 15b is a pulse signal generated each time the car 1 levels with the floor, as mentioned above. The signal is fed to the up-input of the counter B6 by way of the AND gate 9 when the car travels in the up direction, while it is fed to the down-input of the counter B6 by way of the AND gate 10 in the travelling in the down direction. A signal 15a is the one obtained when the car 1 levels with the specific floor, and is used as a loading signal for loading a signal into the counter B6. In the figure, the loading is made in a condition that only the A input of the counter B6 is logical "1" while the others B, C and D are logical "0". This means that the specific floor is assigned for the 1st floor. When the car starts to travel from the 1st floor upwardly, the contents of the counter B6 is increased by one each time the car levels with the floor and, in a normal operation, the counter B6 indicates the position of the car 1 travelling up in terms of the floor. When the car 1 stops, the comparator C4 compares the contents of the counter B6 with that of the counter B5. At this time, if the contents are equal, the elevator system operates with an assumption that the calculations of the counters B5 and B6 are correct. If they are not equal, it is decided that something has caused the counters to operate erroneously. With such a decision, the car 1 is moved to the specific floor and a command to correct the erroneous operation is given to the control circuit (not shown). The control of an AND gate 11 with the output of $A=B$ of the comparator C4 as a command to move the car to the specific floor and to be fed via the AND gate 11, is made by a signal FN for indicating being in stop which is fed from the control circuit (not shown). At the time that the signal FN enables the AND gate 11, if the output of the comparator is $A=B$ and logical "1", the signal of "1" is fed to the control circuit (not shown), thereby permitting the operation to continue. At this time, if the output is logical "0", i.e. $A \neq B$, the signal is the one for indicating the movement of the car to the specific floor.

As described above, the output of the floor indicator representing the floor at which the car actually stops and the output of the stop permissible floor indicator representing the electrically calculated stop floor when the car stops, are compared. In the comparison, when these outputs are

different, the car is moved to the specific floor and, at the specific floor, the floor indicator and the stop permissible floor indicator are set to the specific floor. With such an arrangement, even if slip takes place between the speed regulator rope and the speed regulator sheave and therefore the floor at which the car actually stops is different from the floor indicated by the stop permissible floor indicator, the correction of it may be quickly made, thus ensuring normal elevator service.

WHAT WE CLAIM IS:—

1. An elevator control system including an electric floor selector and comprising: a specific floor unit provided at at least one specific floor in the hoistway and indicating the or each specific floor specifically; non-specific floor units provided at the other floors than the or each specific floor and for indicating the floor non-specifically; detecting means provided on a car for detecting both specific floor units and non-specific floor units and for generating signals corresponding thereto; a floor indicator for indicating the floor at which the car actually stops by using the signal from the detecting means; and a stop permissible floor indicator for indicating, by electrical calculation, the floor at which the car stops, there being a comparator in which comparison is made of the output of said floor indicator with the output of said stop permissible floor indicator; when these outputs are different, the car is moved to the or a specific floor and, when the car stops at the specific floor, said floor indicator and said stop permissible floor indicator are set to said specific floor.

2. An elevator control system including an electric floor selector according to Claim 1, in which a plurality of specific floors are used; a calculation is made of the distances between the floor indicated by said stop permissible indicator or the floor indicated by said floor indicator and the specific floors; and the car is moved toward the nearest specific floor.

3. An elevator control system substantially as hereinbefore described with reference to Figures 3 and 4 of the accompanying drawings.

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