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## ELEVATOR SYSTEM

1           The present invention relates to an elevator  
system for supervising the movement of elevators, and  
more particularly to improvements in an elevator system  
which is suitable for application to a small number of  
5 elevators.

In the system for supervising the movement of  
elevators, the most significant problem is to reduce and  
uniform the waiting time of each user.

For this problem, various techniques have  
10 hitherto been employed.

In the initial stage, it has been practiced  
that zones of which individual elevators take charge are  
determined in accordance with respective positions of a  
plurality of elevators so that the elevators may be  
15 placed at intervals as equally as possible. With  
subsequent development of microcomputers, a hall call  
assignment method has been employed wherein various  
factors are evaluated each time a hall call is generated  
in order to assign an optimum elevator in accordance  
20 with each hall call.

These control methods are techniques of  
optimally serving hall calls generated irregularly. In  
addition, for the sake of serving specified traffic,  
there are available a zoning express running operation  
25 at the office-going hour and an elevator for specified



1 service which takes charge of a specified hall call to  
take care of a specified traffic demand.

JP-A-63-247279 and JP-A-63-247280 disclose a  
specified elevator serving a specified traffic demand.

5 JP-A-63-247279 describes that a numbered machine to be  
specifically served accepts only a cage call from a  
specified floor during a specified high demand occurring  
at a preset hour, so that during a time zone such as the  
lunch hour or the closing hour in which the demand is  
10 heavily concentrated to a specified floor, an elevator  
destined for a specified floor is designated and the  
demand for the specified floor is served by this  
elevator to reduce the one cycle time of the specified  
numbered machine, thereby giving preferential service to  
15 the high-demand floor. JP-A-63-247280 describes that in  
addition to JP-A-63-247279, a plurality of elevators are  
divided into two groups of elevators serving all of the  
floors and of elevators serving specified floors,  
special indicators and special buttons are provided to  
20 the elevators serving the specified floors, and an  
indication purporting the movement to only the specified  
floors is given to the elevators serving the specified  
floors when time comes to a preset hour, thereby  
ensuring that passengers can be served without wavering  
25 in choice.

The hall call assigning method and zone method  
are control methods suitable for the case where the hall  
call is generated irregularly and are not satisfactory



to serve a traffic demand in which a floor from which a hall call is generated and a destination floor are almost determined.

Good service is desired to be given to even a high demand which the hall call assigning method can cope with at the cost of difficulties and the prior arts disclosed in the aforementioned laid-open publications are achieved to solve the problems. But it has been proven that with the prior arts, in a demand in which passengers from individual floors are concentrated to the first floor at the lunch hour, for example, an elevator becomes crowded at higher floors and service to intermediate and lower floors is degraded significantly. It has also been proven that with the aforementioned prior arts, the hour, the specified destination floor and the specified elevator are determined in advance and therefore demands for different destinations cannot be dealt with, resulting in a failure to take care of the demand changeable in various ways.

As described previously, the recent hall call assignment method for assigning a hall call by using total evaluation is used for optimally serving a hall call generated irregularly. Therefore, this method is unsuitable for serving a high demand occurring over specified floors. In the case where group-supervisory control of four or more elevators is carried out, while a certain elevator serves over specified floors, the other elevators are allowed to serve the other floors and

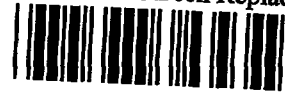


therefore the hall call assignment method can be employed to fulfill itself as far as the demand is not excessively heavy.

However, simulation conducted by the inventors in which that assignment method is applied to two to three elevators at the most has demonstrated that in the case of a demand being concentrated to, for example, the first floor at, for example, the lunch time, crowdedness occurs on the way if the number of boarding persons at higher floors is large, resulting a failure to serve lower floors. Even if crowdedness does not occur, time is much more consumed in a heavy boarding and alighting state than in a light boarding and alighting state, with the result that a vicious circle occurs in which the one cycle time of an elevator is prolonged to increase the waiting time while the number of passengers waiting at each floor is increased to cause the elevator to again undertake heavy movement.

Even with four or more elevators employed, when the demand is significantly high, the localization of demand is heavy and the number of service floors is large, most elevators serve over high-demand floors. As a result, service to the other floors than the high-demand floors is degraded and even in service to the high-demand floors, the one cycle time is increased owing to, for example, a heavy boarding and alighting state and so the waiting time is prolonged, resulting in degraded service.

Co-pending UK application number 9309714.5 relates



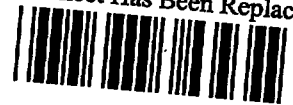
to an elevator system having a plurality of elevators. When a predetermined level of demand is detected for travel between two or more floors, an elevator is assigned to shuttle between those floors only, ignoring  
5 other hall calls.

An object of the present invention is to solve the above problems and to provide an elevator system which can efficiently take care of the traffic demand when it is subject to an unpredictable change or unpredictable  
10 localization.

Accordingly, the present invention provides an elevator system comprising an elevator for servicing a plurality of floors, the system comprising allocation means for allocating the elevator to respond to passenger  
15 calls, the elevator having a normal running mode in which the plurality of floors are serviced, wherein the allocation means acts, when a predetermined level of demand is detected for travel between two or more floors and until the demand for travel between those floors has  
20 fallen below the predetermined level, to assign the elevator alternately to operate in the normal running mode and in a specific floor running mode in which the elevator shuttles between those two or more floors only.

The above and other objects, features and advantages  
25 of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagram showing an example of an



embodiment of the invention;

Figs. 2A-2E are diagrams for explaining an example of schedule running of a single machine;

Fig. 3 is a flow chart of an example of schedule  
5 running of a single machine;

Fig. 4 is a flow chart of high demand measurement.

Figs. 5A-5D are examples of schedule running;

Figs. 6A-6D are examples of schedule running in the case of a single machine;

10 Figs. 7A-7E are diagrams showing examples of express indication;

Figs. 8A-8H are diagrams showing examples in the case where a destination indication is given on an indicator.

15 Fig. 1 is an embodiment of the present invention. A traffic deciding unit 34 included in a numbered machine controller 61 receives information from hall call buttons 101 to 10n, a cage call button 41 and a load sensor included in a cage through the medium of a hall call  
20 collecting unit 31 and a cage information collecting unit 32 to decide traffic and when detecting a high-demand floor or a low service floor, it sends a schedule running command to a running control unit 611 which in turn controls a motor control unit 612 to place the running in  
25 schedule running.

Figs. 2A-2E are diagrams for explaining an example of schedule running in the case of a single machine.

Traffic shown in Fig. 2A is divided into a demand from



the sixth floor to the first floor as shown in Fig. 2B and the other demand as shown in Fig. 2D. In the case of a single machine, a first one-round shuttle running operation is defined, as shown in Fig. 2C, as a period  
5 for serving a high-demand floor as shown in Fig. 2B with a second one-round shuttle running operation defined, as shown in Fig. 2E, as a period for serving the other floors, and the first and second one-round shuttle running operations are carried out alternately at a  
10 constant rate.

Fig. 3 is a flow chart of schedule running in the case of a single machine. When a high-demand floor or a low service floor is detect (601), a floor to be served by schedule running is examined (602), and an indication  
15 purporting the schedule running is given on each floor (603). Since the case of a single machine the provision of a special indicator is seldom, an express indication is given in many applications.

Subsequently, during the first period, a floor  
20 served by the schedule running is indicated (604), an elevator goes non-stop to the served high-demand floor (605) and then goes non-stop from there to a major destination floor (208), thereby performing service of high-demand traffic. During the next period, general  
25 floors other than the high-demand floor are served. At that time, an indication that general floors are served is given (607). Further, when the elevator responds to a call from floors other than the high-demand floor (608)



to reach an end floor after having responded to all the calls from other floors than the high-demand floor, the high-demand condition is checked for its dissolution (210). If the high-demand condition is not dissolved, 5 step (604) and ensuing steps are repeated but if dissolved, the program returns to normal running (212).

Fig. 4 is a flow chart of high demand measurement. Firstly, during normal running, the waiting time at each floor, the boarding time, boarding rate, the number of 10 hall calls, the number of alighting passengers, the occurrence of crowdedness and the wasteful call are measured in respect of one cycle of elevator (202-1), it is then examined whether the crowdedness, pass-by of hall call, wasteful call or long-term wait occurs (202-2) and 15 in the absence of the occurrence, the normal running is allowed to continue. In the absence of the occurrence, the program returns to the normal running but in the presence of the occurrence, on the basis of the time that the crowdedness, pass-by of hall call, wasteful call and 20 long-term wait occur and floors at which they occur, the occurrence is examined as to whether to be attributable to a high demand (202-3). If the occurrence is not due to a high demand, the normal running is allowed to continue but if due to a high demand, the assignment 25 controlling unit 33 transmits a schedule running command to the running control unit 611 to carry out schedule running (202-4).

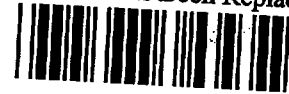
In normal traffic, a floor at which a user gets on



an elevator and a floor at which the user gets off the elevator cannot be presumed in most cases, but a high demand occurs when passengers move between a floor on which entertainments are held and another floor, when  
5 passengers gather at a specified floor at the lunch hour or the closing hour or when traffic directed from a specified floor to another floor takes place at, for example, the office-going hour and therefore, by recording the number of passengers who get on and off  
10 each elevator during one up-and-down cycle thereof, major traffic can be known.

In examining, in (203-3) of Fig. 4, whether the long-term wait is due to a high demand to be served by schedule running of the invention, a method is employed  
15 in which a table based on, for example, an occurrence time zone, an occurrence floor and an occurring event is prepared, and it is decided by looking up this table whether schedule running should be effected. To simplify this table, it can be based on the crowdedness of  
20 elevator, the long-term wait and its occurrence time zone and the long-term wait occurring floor. The table prepared in advance can be set or it may be prepared after operation through learning.

Figs. 5A-5D are diagrams for explaining an example  
25 of schedule running. Shown in Fig. 5A to 5D are traffic types. Shown in Fig. 5A is traffic in which passengers gather from a high-demand floor to a reference floor at, for example, the first half of the lunch hour or the



closing hour or when entertainments held on the rooftop of a department store ends. Shown in Fig. 5B is a case where there are two high-demand floors. Shown in Fig. 5C is traffic in which passengers from a floor disperse to the other floors at, for example, the office-going hour. In contrast to the conventional zoning express during the office-going hour, the present invention is advantageous in that a high demand is not required to occur at the reference floor without exception or within a predetermined time zone, and that when a high demand occurs, schedule running can be carried out in consideration of the overall efficiency. Especially, such a trouble that at the office-going hour, crowdedness occurs at a start floor and up-running service to midway floors is degraded significantly can be prevented. Shown in Fig. 5D is a case where passengers move from a specified floor to another specified floor after, for example, a meeting ends or when passengers go to another entertainment hall after the former entertainments end.

Figs. 6A-6D show examples of a running method according to the invention. To take care of the traffic as shown in Fig. 5A, non-stop service from the sixth floor to the first floor is given during a first period, service to the other floors is given during a second period and the above service operations are repeated alternately as shown in Fig. 6A, thus attaining effects similar to those in the case shown in Fig. 5E. To take care of the case shown in Fig. 5B, there are provided, as



shown in Fig. 6B, a period during which service to the fifth and sixth floors is given and a period during which service to the other floors is given, and the above service operations are repeated alternately. To take  
5 care of aggravated crowdedness, there are provided three service periods as shown in Fig. 6C, of which a first period is for serving the sixth floor, a second period is for serving the fifth floor and third period is for serving the other floors. To take care of the case shown  
10 in Fig. 5D, there are provided, as shown in Fig. 6D, a period for serving specified floors and a period for serving the other floors, thus reducing the boarding time and the boarding rate.

Figs. 7A-7E show examples of an express indication.  
15 Shown in Figs. 7A to 7E are instances where an indication is given to indicators at a floor and a landing stage of an elevator subject to schedule running. Shown in Fig. 7A is an instance where an indication simply purporting express is given. Shown in Fig. 7B is an instance where  
20 floors between which non-stop service is given is indicated by going non-stop from the sixth floor to the first floor. Shown in Fig. 7C is an instance of an indication given when running is brought into schedule running. Shown in Fig. 7D is an instance where a  
25 destination is indicated when running is brought into schedule running. Shown in Fig. 7E is an instance where a service floor and a destination floor are diagrammatically indicated.



Figs. 8A-8H show examples of express indication given on an indicator. Shown in Fig. 8A is an instance where an elevator is at the third floor at which an indicator indicates that the running is about to go into  
5 schedule running and a lamp on the third floor is lit. Shown in Figs. 8B and 8C are an instance where express running is carried out between the sixth floor and the first floor. An express indication is lit and lamps for service floors, that is, the first and sixth floors are  
10 flashed. Shown in Fig. 7C is arrival at the sixth floor. Shown in Fig. 7D is an instance where schedule running is effected between the first floor and each of the sixth and seventh floors. Shown in Figs. 8E and 8F are an instance where schedule running is effected  
15 between the first floor and each of the sixth and seventh floors, with the period for serving the sixth floor separated from the period for serving the seventh floor as shown in Fig. 8C. Firstly, lamps for the seventh and first floors served firstly are lit and indicated, a lamp  
20 for the sixth floor served secondly is lit and indicated in place of the lamp for the seventh floor when the first service ends, and this is repeated until the schedule running ends. Shown in Figs. 8G to 8H is an instance where two indication lamps indicative of express and  
25 normal are provided. When as shown in Fig. 1 a single elevator is subject to schedule running, a period during which the single elevator is subject to press running and a period during which that elevator is subject to normal

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service occur alternately. Under this condition, an  
express indication is given during the period for  
performing express running to give the indication  
described so far and a normal indication is given during  
5 normal service running, thus clarifying which running is  
in execution at present.



### CLAIMS

1. An elevator system comprising an elevator for servicing a plurality of floors, the system comprising allocation means for allocating the elevator to respond  
5 to passenger calls, the elevator having a normal running mode in which the plurality of floors are serviced, wherein the allocation means acts, when a predetermined level of demand is detected for travel between two or more floors and until the demand for travel between those  
10 floors has fallen below the predetermined level, to assign the elevator alternately to operate in the normal running mode and in a specific floor running mode in which the elevator shuttles between those two or more floors only.
- 15 2. An elevator system according to claim 1, wherein in the specific floor running mode the elevator is temporarily assigned to shuttle between either two or three floors only.
3. An elevator system according to claim 1 or claim 2,  
20 wherein the allocation means includes state detection means for detecting a predetermined state at a landing place of a desired floor.
4. An elevator system according to any of the preceding claims, wherein a display is provided to an elevator  
25 landing place of each of the plurality of floors to display, when the predetermined level of demand is detected and the elevator is operating in the specific floor running mode, a service floor of the elevator.





5. An elevator system according to claim 4, wherein the allocation means includes demand detection means for detecting said traffic demand.
6. An elevator system asubstantially as described  
5 herein with reference to Figs. 1 to 3 or to Fig. 6.

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