P/00/011
Section 29

AUSTRALIA
Patents Act 1990

PATENT REQUEST: STANDARD PATENT

I/We, being the person(s) identified below as the Applicant(s), request the grant of a patent to the person(s) identified below as the Nominated Person(s), for an invention described in the accompanying standard complete specification.

Full application details follow.

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673780

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[54] **Invention Title:** Procedure for controlling an elevator group

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BASIC CONVENTION APPLICATION(S) DETAILS

[31] Application Number	[33] Country	Country Code	[32] Date of Application
934993	Finland	FI	11.11.1993

KONE Oy

Juha Hiltunen Olli Rauhakoski
(Signature of Applicant)

21.10.1994
(Date)

AUSTRALIA

Patents Act 1990

NOTICE OF ENTITLEMENT

(To be filed before acceptance)

†/We KONE Oy

of Munkkaniemen puistotie 25,
00330 Helsinki, Finland

being the Applicant(s) in respect of the Application *filed herewith/†No. , state the following:

Part 1 - Must be completed for all applications

The person(s) nominated for the grant of the patent:

~~*is/*are the actual inventor(s)~~

or *has entitlement from the actual inventor(s) by assignment dated 17.09.1993

(eg by assignment dated ..., by reason of normal employment of the inventors, as legal representative of ..., etc)

*Part 2 - Must be completed for all convention applications

The person(s) nominated for the grant of the patent:

*is/*are the applicant(s) of the basic application(s) listed on the patent request form

or ~~*has entitlement from the applicant(s) of the basic application(s) listed on the patent request form~~

(eg by assignment, by consent, etc)

The basic application(s) listed on the request form:

is/~~are~~ the first application(s) made in a Convention country in respect of the invention

or *was/*were not the first application(s) made in a Convention country in respect of the invention, and a request has been made under Section 96 of the Patents Act 1990 (or Section 142AA of the Patents Act 1952) to disregard the following application(s)

* Part 3 - Must be completed for PCT applications.

The person(s) nominated for the grant of the patent:

*is/*are the applicant(s) of the application(s) listed in the declaration under Article 8 of the PCT

or *entitled to rely on the application(s) listed in the declaration under Article 8 of the PCT.

* Part 4 - Must be completed if the application relates to a microorganism and relies on Section 6 of the Act.

The person(s) nominated for the grant of the patent *is/*are:

*the depositor(s) of the deposits listed hereafter (by number, depositary institution and date)

or *entitled to rely on the deposits listed hereafter (by number, depositary institution, date, and depositor's name and address) for the following reasons:

* Part 5 - Must be completed if the application is a Convention application, or the application was made under the PCT and the applicant made a declaration under Article 8 of the PCT in respect of the basic application.

Except as stated in the next paragraph, the basic application(s) *listed on the patent request form/*referred to in the declaration under Article 8 of the PCT *is/*are the application(s) first made in a Convention country in respect of the invention.

A request has been made under Section 96 of the 1990 Act (or Section 142AA of the 1952 Act) to disregard the following application

21.10.1994
Date

KONE Oy

Insert full name: pp. Juha Salomäki pp. Olli Rauhakoski
*Position: Manager Director

By their/his/her Patent Attorneys
COLLISON & CO.

* delete as applicable

AU9477782

(12) PATENT ABRIDGMENT (11) Document No. AU-B-77782/94
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 673780

(54) Title
PROCEDURE FOR CONTROLLING AN ELEVATOR GROUP

(51)[5] International Patent Classification(s)
B66B 001/00

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934993	11.11.93	FI FINLAND

(43) Publication Date : 18.05.95

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KONE OY

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(56) Prior Art Documents
GB 2110423
GB 2129973
GB 2083659

(57) Claim

1. A method for controlling the elevators in an elevator group consisting of two or more elevators in order to serve calls issued by means of call button mounted at the landings, in which method each elevator is controlled by an elevator control unit and the elevator group is controlled by a group control unit and in which a cost function is calculated for the calls, said cost function comprising at least an elevator-specific factor and a floor-specific factor, characterized in that an adjustable weight factor profile is defined for the calls by weighting the calls issued from at least one floor other than the entrance floor with floor-specific weighting coefficients and that the order in which the calls are served is determined by the group control unit.

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Regulation 3.2

AUSTRALIA
Patents Act 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

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KONE OY

Actual Inventors:

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MARJA-LIISA SIIKONEN

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COLLISON & CO.,117 King William Street, Adelaide, S.A. 5000

Invention Title:

PROCEDURE FOR CONTROLLING AN ELEVATOR GROUP

The following statement is a full description of this invention, including the best method of performing it known to us:

The present invention relates to a method for controlling an elevator group.

In the control of the elevators in an elevator group, one objective is to ensure that customers are served in an optimal way in different traffic situations. A customer who presses an elevator call button should be served within a reasonable time both in peak-traffic conditions and during low-traffic hours. Various group control procedures are known which make use of traffic statistics for the control of the elevators or which involve monitoring of the waiting time of customers. A procedure used for group control, more precisely speaking selection of traffic type in group control, is know from patent US 5,229,559.

Previously known group control methods are not adaptable for situations in which the elevator users on a certain floor or certain floors are to be guaranteed a certain average or even above-average level of service. Especially during heavy traffic, e.g. upward and downward peak traffic, floors where the traffic is heavier than average may be ill served. This is because the number of people waiting behind the calls on each floor is generally not known.

The object of the present invention is to develop a group control method which allows individual weighting of each floor or group of floors in the control of the elevators.

To achieve this there is provided according to the invention a method for controlling the elevators in an elevator group consisting of two or more elevators in order to serve calls issued by means of call button mounted at the landings, in which method each elevator is controlled by an elevator control unit and the elevator group is controlled by a group control unit and in which a cost function is calculated for the calls, said cost function comprising at least an elevator-specific factor and a floor-specific factor, characterized in that an

adjustable weight factor profile is defined for the calls by weighting the calls issued from at least one floor other than the entrance floor with floor-specific weighting coefficients and that the order in which the calls are served is determined by the group control unit.

The method of the invention enables the person responsible for the operation of the elevators in a building to define a floor-specific service profile. In peak-traffic situations, the waiting times for the floors selected and for the passengers coming from those floors will not be

longer than the average value, and the waiting times are also shortened in certain traffic situations. The method ~~procedure~~ is suited for use with different group control systems without requiring any other changes in the control.

In the following, the invention is described by the aid of one of its embodiments by referring to the drawings, in which

- Fig. 1 presents a block diagram illustrating the control of an elevator group,
- Fig. 2 presents a block diagram illustrating the principle of group control of an elevator, and
- Fig. 3 illustrates the selection of an elevator by the method of the invention.

The diagram in Fig. 1 illustrates the structure of the control system of an elevator group. The landing calls entered via the call buttons on the various floors of the elevator system are transmitted to the group control unit or elevator control unit associated with the call button in question. The elevator control units 2 are connected to the group control unit 4, which, in the manner described below, handles the allocation of calls to given elevators. In the traffic statistics unit 6, the system accumulates short-term and long-term statistics about the actual traffic, and these are utilized in the group control. The supervision and regulation system 8 of the elevator is connected to the group control unit, to which it gives weighting signals as provided by the invention. The supervision and regulation system 8 may be placed in the machine room of the elevator, as are the elevator and group control units. It can also be placed in conjunction with the building supervision unit and it provides authorized persons the right to make changes in the system. The elevator control 2, group control 4 and supervision and regulation 8 units are preferably interlinked via a serial communication network. Correspondingly, the actuating elements 10 of the elevator, such as the call and signalling devices, are also connected to the elevator control unit via

serial communcation links.

In the following, a possible system for the distribution of calls between different elevators is described by the aid of Fig. 2. On the basis of statistical data (block 12) and real-time data (block 14), a traffic predictor in the group control unit determines the manner in which the elevator cars are to be dispatched to serve landing calls (block 16). The statistics are generated by determining the car load by means of a load-weighing device and photosensitive cells detecting the transitions of persons into and out of the car and by considering the car calls and landing calls issued. Long-term statistics are generated to determine e.g. the variations during a day, and short-term statistics e.g. to recognize the prevailing traffic situation, block 18. Based on the events relating to the operation of the elevator and on the statistics, a traffic type is formed e.g. in the manner described in US patent 5,229,559. In each application, a desired number of traffic types, e.g. up-peak, down-peak, two-way traffic, inter-floor and mixed traffic, can be defined as required, depending on the size of the elevator group and the traffic volume. According to the traffic type, different call types, such as landing calls from the entrance floor, landing calls in the up-direction from intermediate floors and down-calls, are assigned a certain weight. These weight values define the relative importance of different landing calls within the traffic type selected. These weight values are determined according to the long-term statistics, the number of elevators belonging to the elevator group, the traffic volume and the use of the building. In an up-peak situation, calls issued from the entrance floor are given a weight value of e.g. 4 while calls from other floors have a weight value of 2. For smooth traffic and even other traffic types, the weight values can be the same for all floors.

According to the invention, landing calls issued from certain floors are assigned an extra weight factor λ, by which

the serving times relating to these floors are multiplied when the elevator cars are allocated to serve the calls. In a commercial building, e.g. the down-calls from a certain floor can be weighted due to the large number of customers visiting the premises on the floor and to the intense traffic involved. The cost function S(1,f) of the serving time is of the form

$$S(1,f) = ETA(1) + \lambda_f * CT_f, \quad (1)$$

where ETA(1)= estimated travel time of elevator 1 to floor f,
λ_f = weight factor for floor f, and
CT_f = call time of call issued from floor f.

The cost function may also be e.g. of the form

$$S(1,f) = \lambda_f * (ETA(1) + CT_f), \quad (2)$$

in which case the floor-specific weight value has an effect on the predicted serving time.

Fig. 3 illustrates the selection of the best elevator by using the cost function given in equation (1). The traffic predictor 20 produces a weight factor λ_f for the floor. The call time CT_f generated in block 22 is multiplied by the weight factor. The estimated time of arrival ETA obtained from block 24 is added to the weighted call time in block 25 and in this way a cost function is generated in block 26. In the elevator selection block 28, the best elevator is selected for each landing call in such a way that each call will be served in the best manner possible in the prevailing situation. For the selection, different elevators are considered in order to minimize the cost function and, based on this, the best elevator is selected. The broken line visualizes a ~~procedure~~ method according to equation 2, in which the weight factor affects the predicted serving time.

The use of weight factors is preferably limited to certain

times of the day or certain days of the week when the traffic intensity or other cause requiring a higher priority varies periodically. For instance, the open time or closing time of a restaurant or the time of use of a conference room may constitute such a situation. The weight factor for a floor is changed either permanently, for repeated periods or for a certain time only. The weight factor is preferably determined by the person responsible for the functions of the building. The selection apparatus is placed in the supervision unit 8 of the elevator group and is thus connected to the group control unit 6 via a serial communication link.

The weight values determined on the basis of the traffic type given by the traffic predictor and the weight factors for different floors are applied to the serving time associated with each landing call in the calculation of the cost function and the allocation of elevator cars for different calls. This is perfomed in the allocation block in Fig. 2, where the target floors for the elevator cars are determined. During this estimation, an optimal allocation of target floors to different elevators is repeatedly calculated on the basis of the car load, car calls and landing calls for the elevators in the group and of data determined from these. In the case of landing calls, the evaluation is based on the call time, i.e. the time which has elapsed from the moment a given landing call was issued to the moment it is served. Another ground of evaluation is the passenger's waiting time, which means that the average waiting time for the passengers behind each landing call is determined.

When weighting according to the invention is employed, the method of allocation of calls may vary in the scope of known methods, and so can the group control methods.

Though the invention is described above by the aid of one of its embodiments, the presentation is not to be regarded as a restriction but the embodiments of the invention may be varied within the limits defined by the following claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method for controlling the elevators in an elevator group consisting of two or more elevators in order to serve calls issued by means of call button mounted at the landings, in which method each elevator is controlled by an elevator control unit and the elevator group is controlled by a group control unit and in which a cost function is calculated for the calls, said cost function comprising at least an elevator-specific factor and a floor-specific factor, characterized in that an adjustable weight factor profile is defined for the calls by weighting the calls issued from at least one floor other than the entrance floor with floor-specific weighting coefficients and that the order in which the calls are served is determined by the group control unit.

2. A method according to claim 1, characterized in that the weight factor profile is defined on the basis of the intensity of passenger traffic on the floor.

3. A method according to claim 1, characterized in that the weight factor profile can be adjusted separately for each floor.

4. A method according to claims 1 - 3, characterized in that the order in which the calls are served is determined on the basis of the call time.

5. A method according to claims 1 - 3, characterized in that the order in which the calls are served is determined on the basis of the customer's waiting time.

6. A method according to claims 1 - 5, characterized in that the weight factors are permanently in force.

7. A method according to claims 1 - 5, characterized in that the weight factors vary as a function of time.

8. A method for controlling the elevators in an elevator group substantially as herein before described with reference to and as illustrated in the accompanying drawings.

Dated this 26th day of September 1996

KONE OY
By their Patent Attorneys
COLLISON & CO.

ABSTRACT OF DISCLOSURE

The invention relates to a procedure for controlling an elevator group. According to the invention, the landing calls issued from different floors are weighted by a floor-specific weight factor. The weighted call time is utilized in the calculation of the serving time of the calls and for the selection of the best elevator to serve a landing call.

Fig. 1

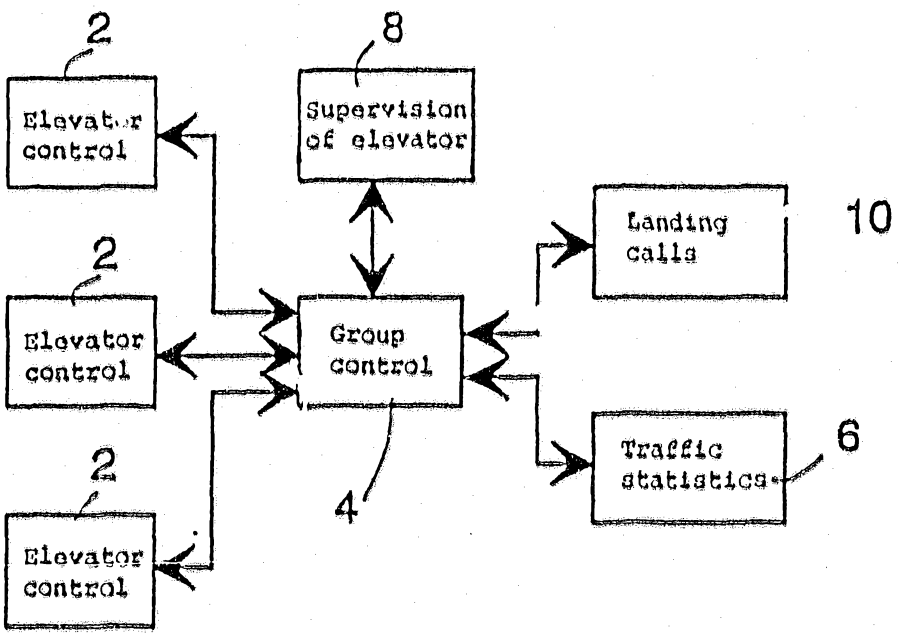
2
Elevator control
8
Supervision of elevator
Landing calls
10
2
Elevator control
Group control
2
Elevator control
4
Traffic statistics
6

Fig.1

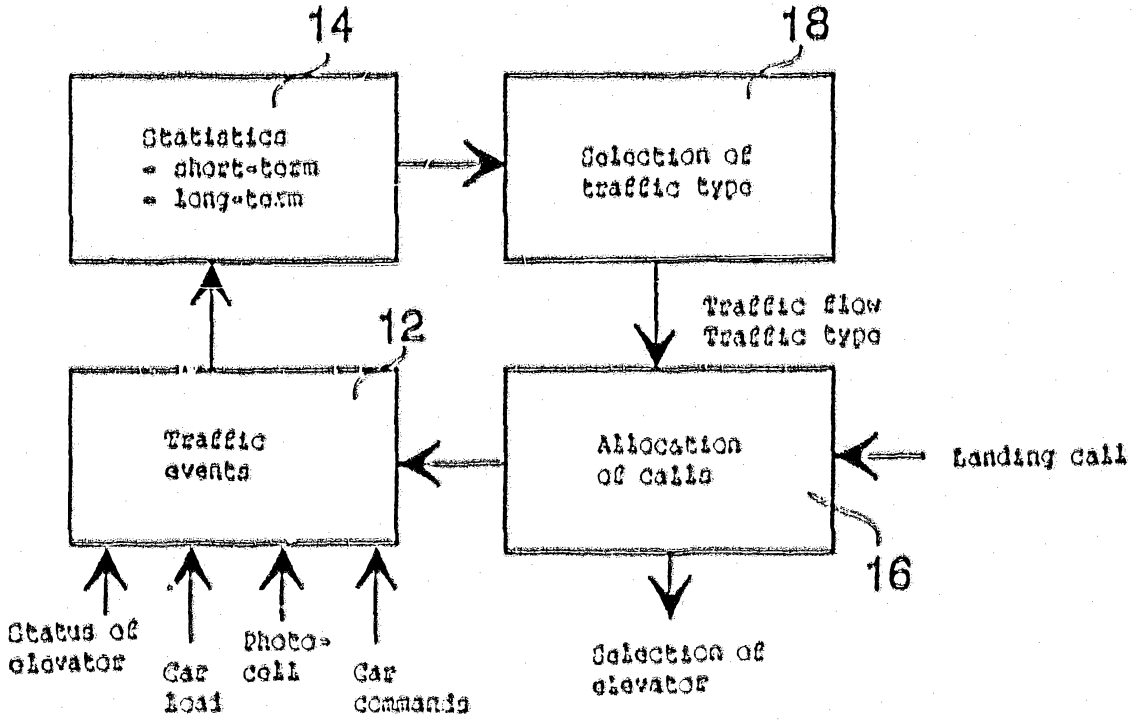
14
Statistics
- short-term
- long-term
18
Selection of traffic type
Traffic flow
Traffic type
12
Traffic events
Allocation of calls
Landing call
16
Status of elevator
Car load
Photo-cell
Car commands
Selection of elevator

Fig. 2

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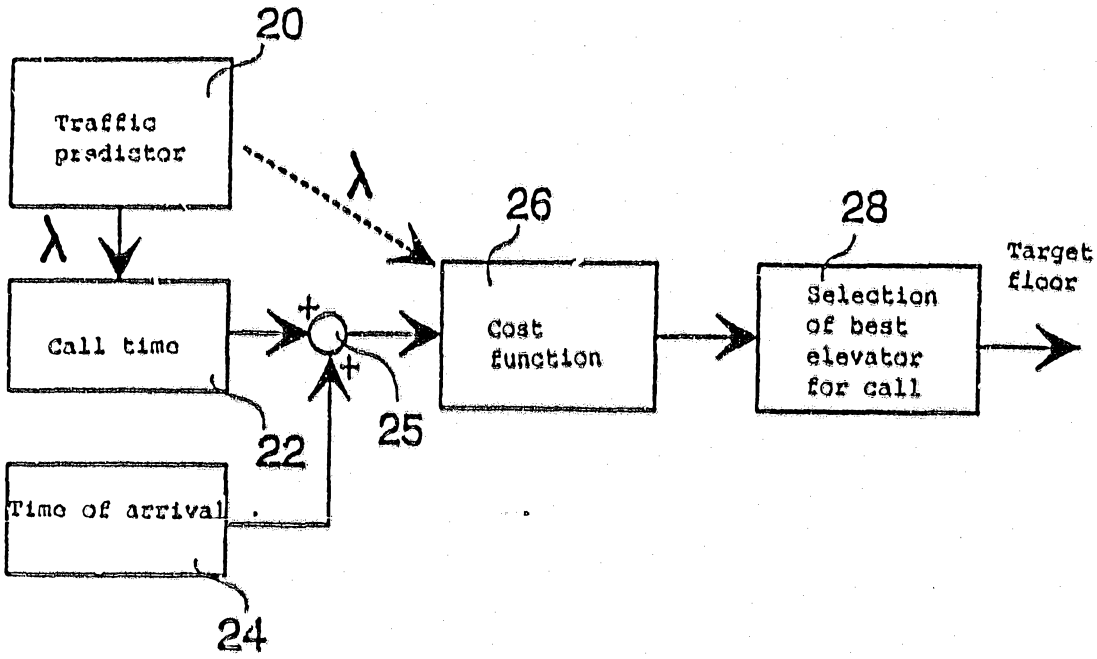

Fig.3