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(54) **ELEVATOR GROUP MANAGEMENT FOR OCCUPANT EVACUATION**

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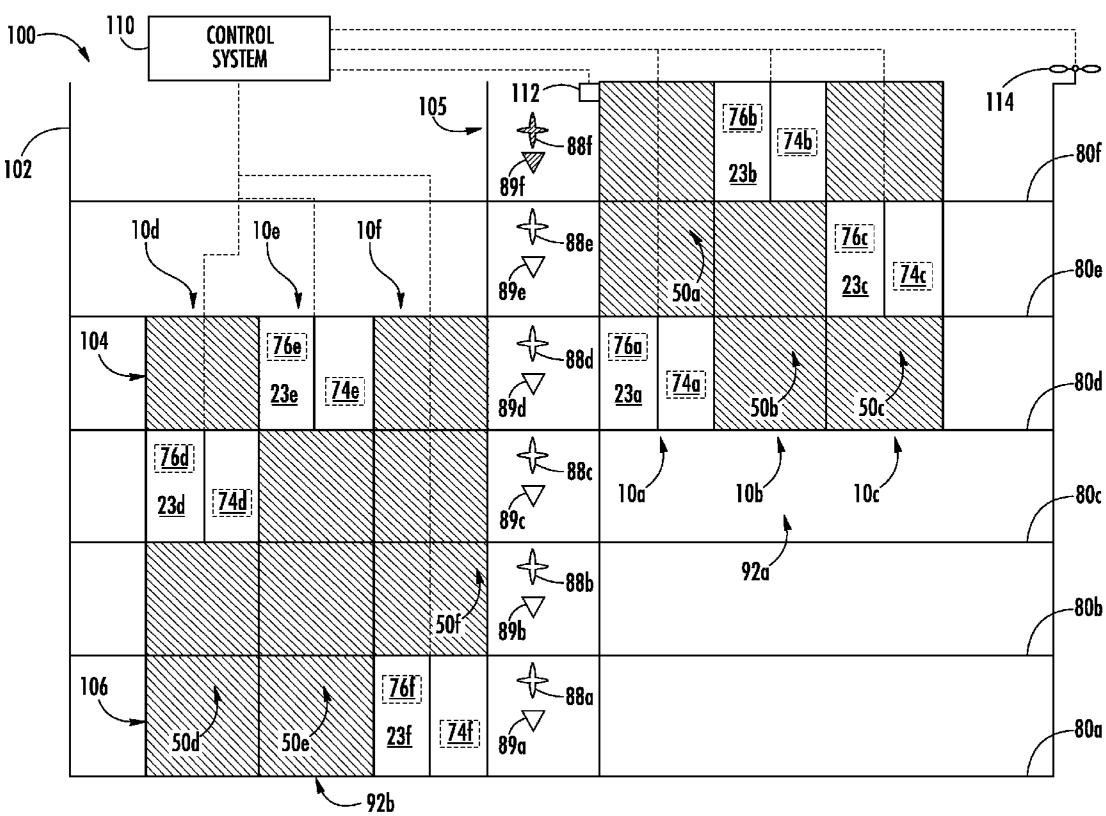
(57) **ABSTRACT**

A method of operating a building elevator system includes determining that an evacuation call is active for an evacuation floor serviced by a first elevator group. A transfer floor serviced by the first elevator group is set as an evacuation discharge floor of the first elevator group. A second elevator group is requested to enter an evacuation mode of operation. The second elevator group is operable to service the transfer floor and a discharge floor. The transfer floor is set as the evacuation floor of the second elevator group. Control of the first elevator group and the second elevator group is coordinated to evacuate one or more occupants from the evacuation floor serviced by the first elevator group to the discharge floor serviced by the second elevator group.



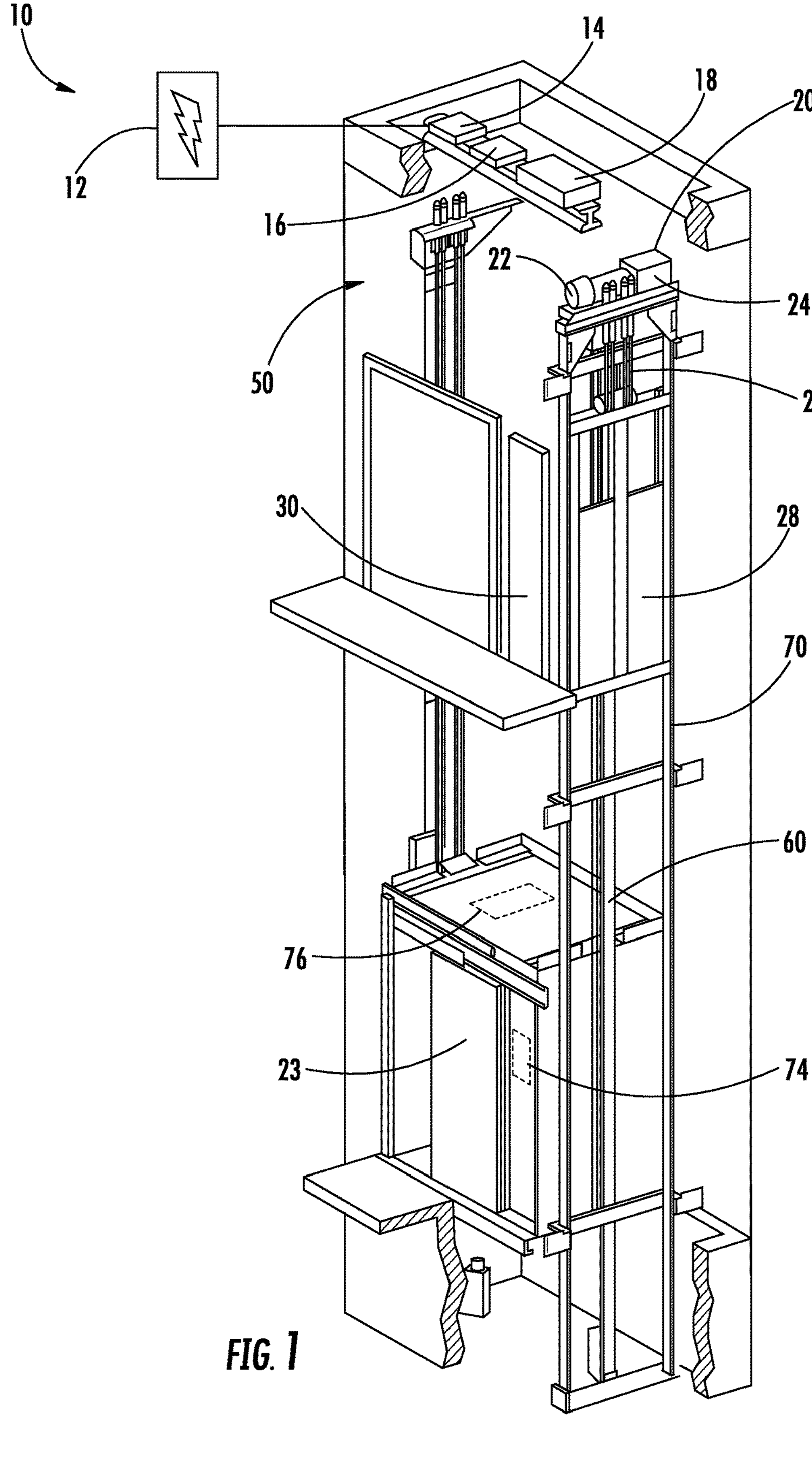


FIG. 1

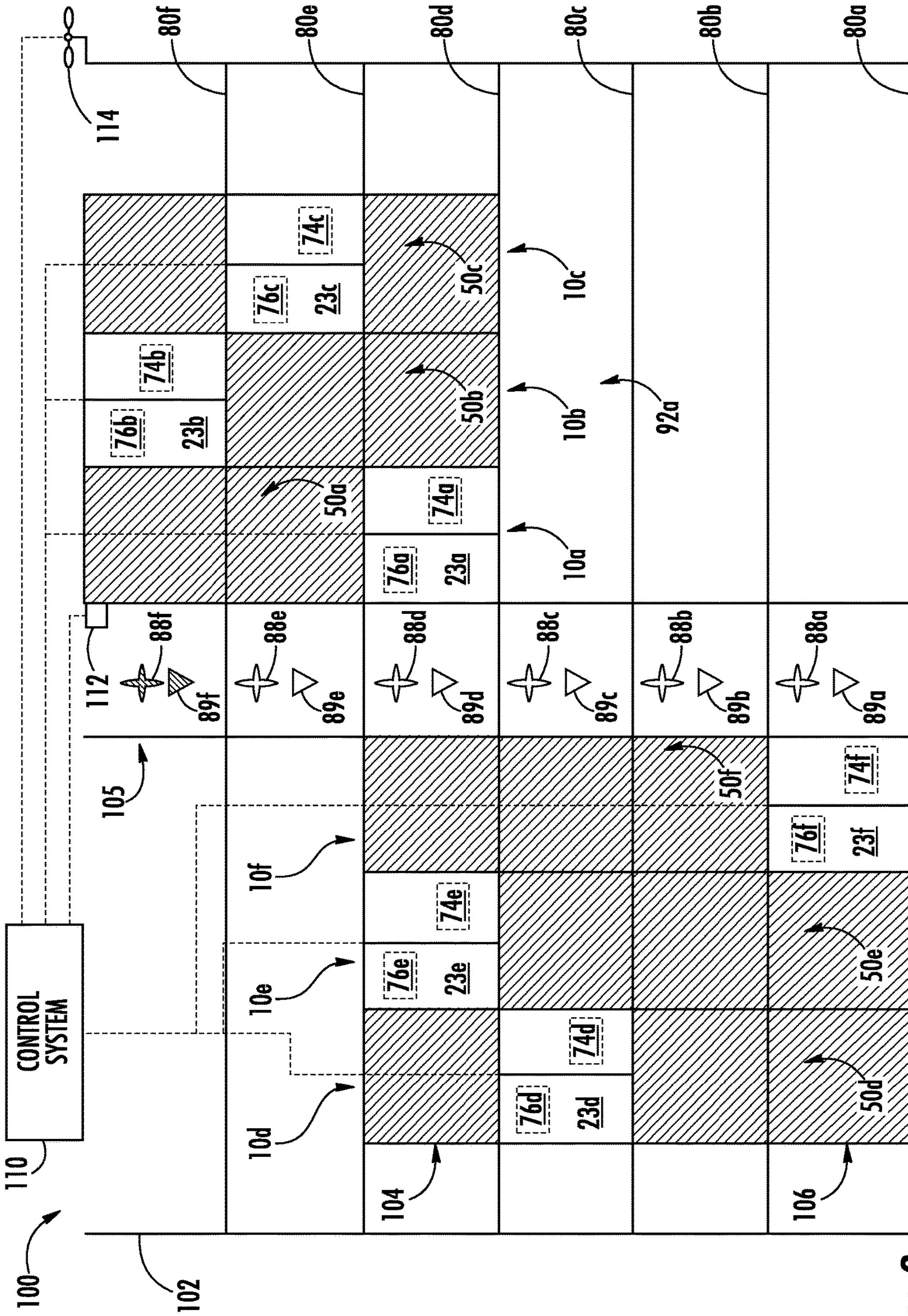

CONTROL SYSTEM
100
102
104
105
106
110
112
114
10a
10b
10c
10d
10e
10f
23a
23b
23c
23d
23e
23f
50a
50b
50c
50d
50e
50f
74a
74b
74c
74d
74e
74f
76a
76b
76c
76d
76e
76f
80a
80b
80c
80d
80e
80f
88a
88b
88c
88d
88e
88f
89a
89b
89c
89d
89e
89f
92a
92b

FIG. 2

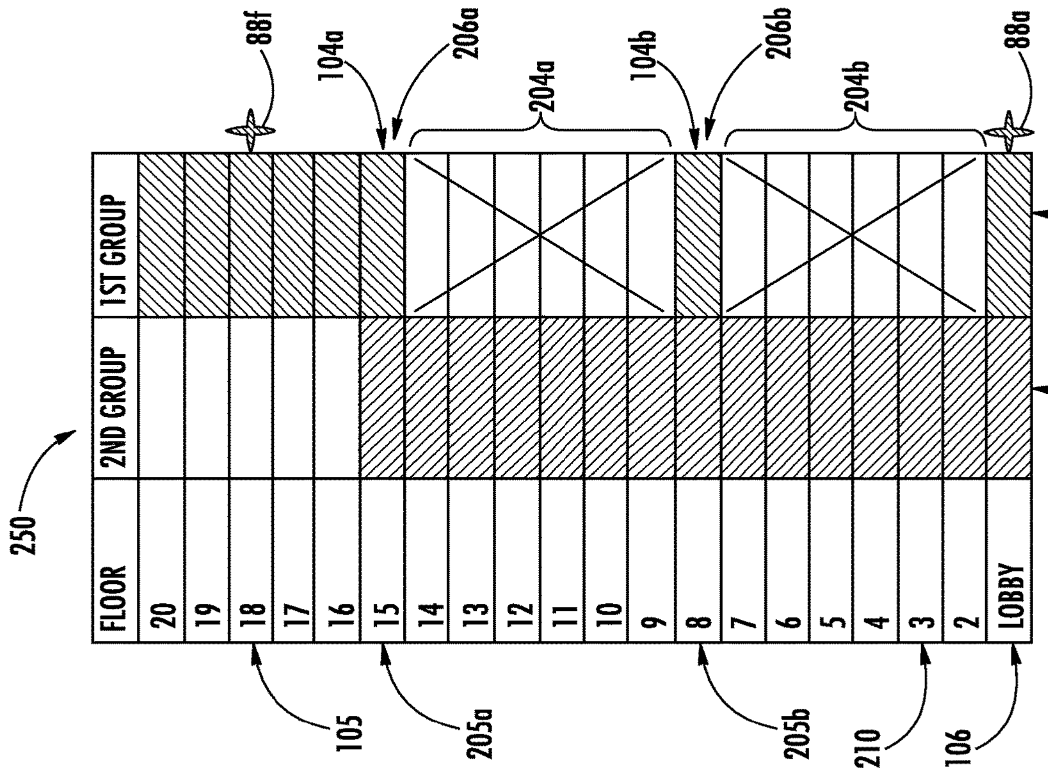

250
FLOOR
2ND GROUP
1ST GROUP
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
LOBBY
88f
104a
206a
204a
104b
206b
204b
88a
92a
92b
105
205a
205b
210
106

FIG. 4

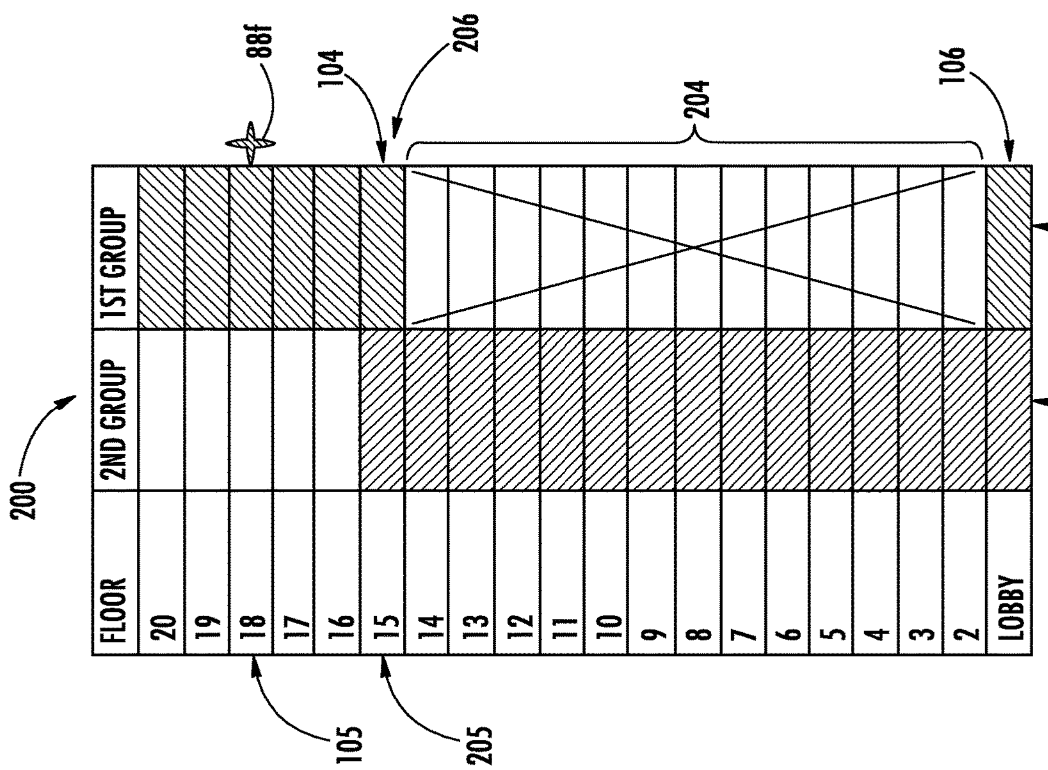

200
FLOOR
2ND GROUP
1ST GROUP
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
LOBBY
88f
104
206
204
106
92a
92b
105
205

FIG. 3

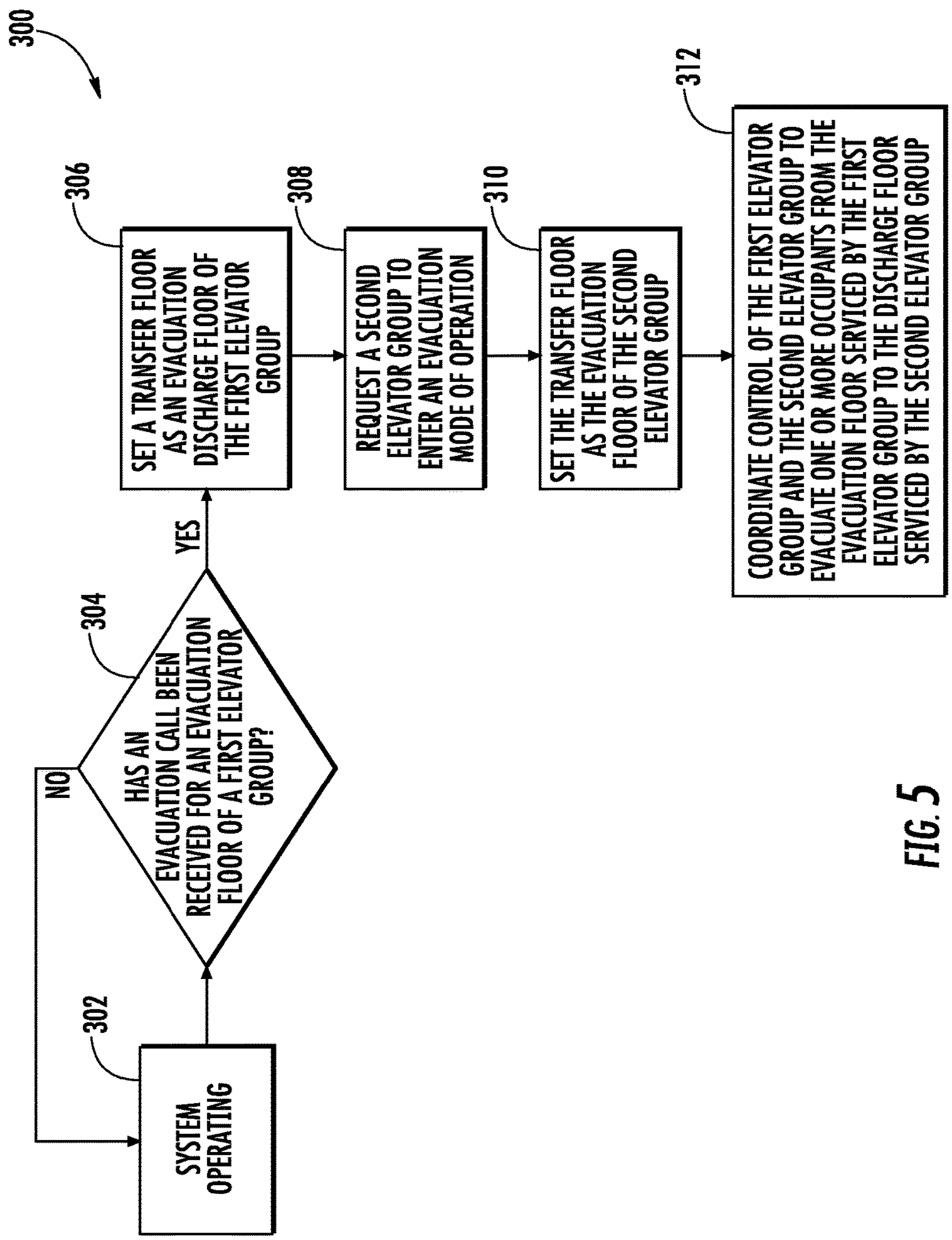

300
302
SYSTEM OPERATING
304
HAS AN EVACUATION CALL BEEN RECEIVED FOR AN EVACUATION FLOOR OF A FIRST ELEVATOR GROUP?
NO
YES
306
SET A TRANSFER FLOOR AS AN EVACUATION DISCHARGE FLOOR OF THE FIRST ELEVATOR GROUP
308
REQUEST A SECOND ELEVATOR GROUP TO ENTER AN EVACUATION MODE OF OPERATION
310
SET THE TRANSFER FLOOR AS THE EVACUATION FLOOR OF THE SECOND ELEVATOR GROUP
312
COORDINATE CONTROL OF THE FIRST ELEVATOR GROUP AND THE SECOND ELEVATOR GROUP TO EVACUATE ONE OR MORE OCCUPANTS FROM THE EVACUATION FLOOR SERVICED BY THE FIRST ELEVATOR GROUP TO THE DISCHARGE FLOOR SERVICED BY THE SECOND ELEVATOR GROUP

FIG. 5

ELEVATOR GROUP MANAGEMENT FOR OCCUPANT EVACUATION

BACKGROUND

[0001] The subject matter disclosed herein relates generally to the field of elevator systems, and specifically to a method and apparatus for coordinating the operation of multiple elevator cars.

[0002] Commonly, very tall buildings (ex: high rise or sky scrapers) require sky lobbies or transfer floors, which are intermediate interchange (i.e. transfer) floors where people may transfer from an elevator serving an upper portion of the building to an elevator serving a lower portion of the building. Some elevator systems can be operable during an emergency to evacuate occupants between an evacuation floor and a discharge floor. However, if travel between the evacuation floor and the discharge floor is impeded, occupants may have to use the stairs instead.

BRIEF DESCRIPTION

[0003] According to one embodiment, a method of operating a building elevator system includes determining that an evacuation call is active for an evacuation floor serviced by a first elevator group. A transfer floor serviced by the first elevator group is set as an evacuation discharge floor of the first elevator group. A second elevator group is requested to enter an evacuation mode of operation. The second elevator group is operable to service the transfer floor and a discharge floor. The transfer floor is set as the evacuation floor of the second elevator group. Control of the first elevator group and the second elevator group is coordinated to evacuate one or more occupants from the evacuation floor serviced by the first elevator group to the discharge floor serviced by the second elevator group.

[0004] In addition to one or more of the features described above or below, or as an alternative, further embodiments may include where the evacuation floor serviced by the first elevator group is unreachable by the second elevator group.

[0005] In addition to one or more of the features described above or below, or as an alternative, further embodiments may include where requesting the second elevator group to enter the evacuation mode of operation is performed based on determining that the first elevator group is inhibited from traveling to the discharge floor.

[0006] In addition to one or more of the features described above or below, or as an alternative, further embodiments may include where determining that the first elevator group is inhibited from traveling to the discharge floor is based on detecting a degraded hoistway condition.

[0007] In addition to one or more of the features described above or below, or as an alternative, further embodiments may include monitoring one or more conditions of the discharge floor, setting the evacuation discharge floor of the second elevator group to an alternate discharge floor based on detecting one or more degraded conditions at the discharge floor, and restricting travel of the second elevator group between the alternate discharge floor and the discharge floor.

[0008] In addition to one or more of the features described above or below, or as an alternative, further embodiments may include changing the evacuation discharge floor of one or more elevator cars of the first elevator group to a secondary transfer floor.

[0009] In addition to one or more of the features described above or below, or as an alternative, further embodiments may include where the evacuation mode of operation prioritizes travel between the transfer floor and the discharge floor over one or more requests received from one or more elevator call buttons between the transfer floor and the discharge.

[0010] According to another embodiment, control system of a building elevator system includes a processor and a memory including computer-executable instructions that, when executed by the processor, cause the processor to perform operations. The operations include determining that an evacuation call is active for an evacuation floor serviced by a first elevator group, setting a transfer floor serviced by the first elevator group as an evacuation discharge floor of the first elevator group, and requesting a second elevator group to enter an evacuation mode of operation, the second elevator group operable to service the transfer floor and a discharge floor. The operations also include setting the transfer floor as the evacuation floor of the second elevator group and coordinating control of the first elevator group and the second elevator group to evacuate one or more occupants from the evacuation floor serviced by the first elevator group to the discharge floor serviced by the second elevator group.

[0011] According to another embodiment, a computer program product is tangibly embodied on a computer readable medium. The computer program product includes instructions that, when executed by a processor, cause the processor to perform operations. The operations include determining that an evacuation call is active for an evacuation floor serviced by a first elevator group, setting a transfer floor serviced by the first elevator group as an evacuation discharge floor of the first elevator group, and requesting a second elevator group to enter an evacuation mode of operation, the second elevator group operable to service the transfer floor and a discharge floor. The operations also include setting the transfer floor as the evacuation floor of the second elevator group and coordinating control of the first elevator group and the second elevator group to evacuate one or more occupants from the evacuation floor serviced by the first elevator group to the discharge floor serviced by the second elevator group.

[0012] Technical effects of embodiments of the present disclosure include elevator group control for occupant evacuation.

[0013] The foregoing features and elements may be combined in various combinations without exclusivity, unless expressly indicated otherwise. These features and elements as well as the operation thereof will become more apparent in light of the following description and the accompanying drawings. It should be understood, however, that the following description and drawings are intended to be illustrative and explanatory in nature and non-limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

[0015] FIG. **1** illustrates a schematic view of an elevator assembly, in accordance with an embodiment of the disclosure;

[0016] FIG. **2** illustrates a schematic view of a building elevator system, in accordance with an embodiment of the disclosure;

[0017] FIG. **3** illustrates a schematic view of a building elevator configuration, in accordance with an embodiment of the disclosure;

[0018] FIG. **4** illustrates a schematic view of a building elevator configuration, in accordance with an embodiment of the disclosure; and

[0019] FIG. **5** is a flow chart of method of operating a building elevator system, in accordance with an embodiment of the disclosure.

DETAILED DESCRIPTION

[0020] A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

[0021] FIG. **1** shows a schematic view of an elevator assembly **10**, in accordance with an embodiment of the disclosure. FIG. **2** shows schematic view of a building elevator system **100**, in accordance with an embodiment of the disclosure. With reference to FIG. **1**, the elevator assembly **10** includes an elevator car **23** configured to move vertically upward and downward within a hoistway **50** along a plurality of car guide rails **60**. The elevator assembly **10** also includes a counterweight **28** operably connected to the elevator car **23** via a pulley system **26**. The counterweight **28** is configured to move vertically upward and downward within the hoistway **50**. The counterweight **28** moves in a direction generally opposite the movement of the elevator car **23**, as is known in conventional elevator assemblies. Movement of the counterweight **28** is guided by counterweight guide rails **70** mounted within the hoistway **50**.

[0022] The elevator assembly **10** also includes a power source **12**. The power is provided from the power source **12** to a switch panel **14**, which may include circuit breakers, meters, etc. From the switch panel **14**, the power may be provided directly to the drive unit **20** through the controller **30** or to an internal power source charger **16**, which converts alternating current (AC) power to direct current (DC) power to charge an internal power source **18** that requires charging. For instance, an internal power source **18** that requires charging may be a battery, capacitor, or any other type of power storage device known to one of ordinary skill in the art. Alternatively, the internal power source **18** may not require charging from the external power source **12** and may be a device such as, for example a gas powered generator, solar cells, hydroelectric generator, wind turbine generator or similar power generation device. The internal power source **18** may power various components of the elevator assembly **10** when an external power source is unavailable. The drive unit **20** drives a machine **22** to impart motion to the elevator car **23** via a traction sheave of the machine **22**. The machine **22** also includes a brake **24** that can be activated to stop the machine **22** and elevator car **23**. As will be appreciated by those of skill in the art, FIG. **1** depicts a machine room-less elevator assembly **10**, however the embodiments disclosed herein may be incorporated with other elevator assemblies that are not machine room-less or that include any other known elevator configuration. In addition, hydraulic elevator systems, elevator systems having more than one independently operating elevator car in each elevator shaft and/or ropeless elevator systems may also be used. In one embodiment, the elevator car may have two or more compartments.

[0023] The controller **30** is responsible for controlling the operation of the elevator assembly **10**. The controller **30** is tied to a control system **110** (FIG. **2**), which is responsible for controlling multiple elevator assemblies and will be discussed below. The controller **30** may also determine a mode (motoring, regenerative, near balance) of the elevator car **23**. The controller **30** may use the car direction and the weight distribution between the elevator car **23** and the counterweight **28** to determine the mode of the elevator car **23**. The controller **30** may adjust the velocity of the elevator car **23** to reach a target floor. The controller **30** may include a processor and an associated memory. The processor may be, but is not limited to, a single-processor or multi-processor system of any of a wide array of possible architectures, including field programmable gate array (FPGA), central processing unit (CPU), application specific integrated circuits (ASIC), digital signal processor (DSP) or graphics processing unit (GPU) hardware arranged homogenously or heterogeneously. The memory may be but is not limited to a random access memory (RAM), read only memory (ROM), or other electronic, optical, magnetic or any other computer readable medium.

[0024] As seen in FIG. **2**, a building elevator system **100** within a building **102** may include multiple different individual elevator assemblies **10***a*-**10***f*. The elevator assemblies **10** may be divided up into two or more elevator groups **92***a*, **92***b*. In very tall buildings (ex: high rise and skyscrapers) with a large number of floors **80***a*-**80***f*, multiple elevator groups **92***a*, **92***b* may be used to get occupants to desired destinations faster and more efficiently. Multiple elevator groups **92***a*, **92***b* may also exist in shorter buildings for various other reasons including but not limited to, efficiency and/or structural constraints. FIG. **2** includes a first elevator group **92***a* and a second elevator group **92***b*. Floor coverage of each elevator group **92***a*, **92***b* typically overlaps at a transfer floor **104** (ex: sky lobby), so that occupants may disembark one of the elevator groups **92***a*, **92***b* and enter another. Buildings may have multiple transfer floors **104** including a first transfer floor **104***a* and a second transfer floor **104***b* (FIG. **4**). As seen in FIG. **2**, the floor coverage of the first elevator group **92***a* overlaps the floor coverage of the second elevator group **92***b* at floor **80***d*, which is considered the transfer floor **104**. Each elevator group **92***a*, **92***b* may have one or more elevator assemblies **10***a*-**10***f* having elevator cars **23***a*-**23***f* in an elevator hoistway **50***a*-**50***d*. In an embodiment, the first elevator group **92***a* is at a higher elevation than the second elevator group **92***b* in the building **102**. That is, the first elevator group **92***a* serves floors **80***d*-**80***f* and the second elevator group **92***b* serves floors **80***a*-**80***d*. In order for a passenger from floors **80***a*-**80***c* to reach floors **80***e*-**80***f*, they would need to transfer from second elevator group **92***b* to first elevator group **92***a* at floor **80***d*. While the building **102** of FIG. **2** is depicted with six floors, buildings may have any desired number of floors. Moreover, the second elevator group **92***b* and first elevator group **92***a* may each serve any number of independent and overlapping floors as desired.

[0025] Each floor **80***a*-**80***f* in the building **102** of FIG. **2** may have an elevator call button **89***a*-**89***f* and an evacuation alarm **88***a*-**88***f* The elevator call button **89***a*-**89***f* sends an elevator call to the control system **110**. The elevator call button **89***a*-**89***f* may be a push button and/or a touch screen and may be activated manually or automatically. For example, the elevator call button **89***a*-**89***f* may be activated by a building occupant pushing the elevator call button **89***a*-**89***f* The elevator call button **89***a*-**89***f* may also be activated by voice recognition or a passenger detection mechanism in the hallway, such as, for example a weight sensing device, a visual recognition device, and a laser detection device. The evacuation alarm **88***a*-**88***f* may be activated or deactivated either manually or automatically through an alarm system (not depicted) operable to alert building occupants of conditions and threats relevant to elevator operation (e.g., fire, chemical, biological agents or smoke near points of elevator entry/egress). If the evacuation alarm **88***a*-**88***f* is activated, an evacuation call is sent to the control system **110** indicating the respective floor **80***a*-**80***f* where the evacuation alarm **88***a*-**88***f* was activated. In the example of FIG. **2**, an evacuation alarm **88***f* is activated, and floor **80***f* is the evacuation floor **105**.

[0026] In building **102** having a second elevator group **92***b* and a first elevator group **92***a*, in the case of an evacuation, elevator cars **23***a*-**23***c* of the first elevator group **92***a* may carry occupants to the transfer floor **104** for evacuation, and the control system **110** may send elevator cars **23***d*-**23***f* of the second elevator group **92***b* to the transfer floor **104** to receive the occupants exiting the elevator cars **23***a*-**23***c* of the first elevator group **92***a* and, thereby, return them to a discharge floor **106**, e.g., the ground floor (or any other desired evacuation floor) for evacuation. In the example of FIG. **2**, the discharge floor **106** may be floor **80***a*, such as a lobby of building **102**. In one embodiment, the discharge floor **106** may be any desired floor that allows people to evacuate the building or otherwise offers people safety (e.g., a floor with a refuge space).

[0027] The control system **110** is operably connected to the controller **30** (see FIG. **1**) of each elevator assembly **10**. The control system **110** is configured to the control and coordinate operation of multiple elevator groups **92***a*, **92***b*. The control system **110** may be an electronic controller including a processor and an associated memory comprising computer-executable instructions that, when executed by the processor, cause the processor to perform various operations. The processor may be, but is not limited to, a single-processor or multi-processor system of any of a wide array of possible architectures, including field programmable gate array (FPGA), central processing unit (CPU), application specific integrated circuits (ASIC), digital signal processor (DSP) or graphics processing unit (GPU) hardware arranged homogenously or heterogeneously. The memory may be but is not limited to a random access memory (RAM), read only memory (ROM), or other electronic, optical, magnetic or any other computer readable medium.

[0028] The elevator groups **92***a*, **92***b* may also include a notification device **74** as seen in FIG. **1**, and each elevator group **92***a*, **92***b* may include a notification device **74***a*-**74***f* as seen in FIG. **2**. The notification device **74***a*-**74***f* may be located within the individual elevator cars **23***a*-**23***f*, at each floor **80***a*-*f*, and/or on the transfer floor **104**. The notification device **74***a*-**74***f* is in operative communication with the control system **110**. The notification device **74***a*-**74***f* can be configured to provide transfer instructions to occupants. For example, the transfer instructions may describe where on the transfer floor **104** to board an elevator car **23***d*-**23***f* of the second elevator group **92***b* when the occupants are disembarking an elevator car **23***a*-**23***c* of the first elevator group **92***a*. The notification device **74***a*-**74***f* may provide transfer instructions in audible and/or visual form.

[0029] The elevator assemblies **10***a*-**10***f* may also include a sensor system **76** configured to detect a number of occupants in a particular elevator car **23**, as seen in FIG. **1**. The sensor system **76** is also seen in FIG. **2**, as sensor systems **76***a*-**76***f* The sensor system **76** is in operative communication with the control system **110**. The sensor system **76** may use a variety of sensing mechanisms such as, for example, a visual detection device, a weight detection device, a laser detection device, a door reversal monitoring device, a thermal image detection device, and a depth detection device. The visual detection device may be a camera that utilizes visual recognition to identify and count individual passengers. The weight detection device may be a scale to sense the amount of weight in an elevator car **23** and then determine the number of passengers from the weight sensed in combination with one or more other sensing mechanisms, such as a door detector. The laser detection device may detect how many passengers walk through a laser beam to determine the number of passengers in the elevator car **23**. Similarly, a door reversal monitoring device also detects passengers entering the car so as not to close the elevator door on a passenger and thus may be used to determine the number of passengers in the elevator car **23**. The thermal detection device may be an infrared or other heat sensing camera that utilizes detected temperature to identify and count individual passengers in combination with other image-based detection for headcounts, facial detection, and/or other sensing techniques. The depth detection device may be a 2-D, 3-D or other depth/distance detecting camera that utilizes detected distance to an object to identify and count individual passengers. As may be appreciated by one of skill in the art, in addition to the stated methods, additional methods may exist to sense the number of passengers and one or any combination of these methods may be used to determine the number of passengers in the elevator car. In addition or in place of counting the number of occupants, the control system **110** may detect the amount of free and/or occupied space in the elevator car **23** and use this data instead of passenger count. In some embodiments, the control system **110** may estimate the number of occupants based upon the amount of free and/or occupied space (along with weight data) in the elevator car **23**.

[0030] Determining the number of occupants in an elevator car **23***a*-**23***c* of the first elevator group **92***a* approaching the transfer floor may help the control system **110** determine how many elevators cars **23***d*-**23***f* to send to the transfer floor **104** from the second elevator group **92***b*. The control system **110** is configured to determine the number of occupants in an elevator car **23***a*-**23***c* of the first elevator group **92***a* so as to send the appropriate number of elevators cars **23***d*-**23***f* from the second elevator group **92***b* to the transfer floor **104**, which can expedite transferring passengers between the two elevator groups **92***a*, **92***b*.

[0031] In embodiments, the control system **110** can determine one or more conditions of the building **102** to assist in determining whether travel of elevator cars **23***a*-**23***c* of the first elevator group **92***a* can reach a desired floor. For example, the control system **110** can monitor a building sway sensor **112**, a wind sensor **114**, and/or other environmental sensors. The sway sensor **112** can monitor motion magnitude and/or frequency of motion of the building **102**, for instance due to seismic activity or wind. The wind sensor **114** may assist in quantifying the source of motion of the building **102** and the intensity level of a building sway event. The sway sensor **112** may be accelerometer based, pendulum based, or optically based, for example, to determine the magnitude and frequency of movement of a portion of the building **102**.

[0032] In some embodiments, the first elevator group **92***a* is an express elevator system that is accessible from the discharge floor **106** under normal operating conditions, as depicted in the example building elevator configuration **200** of FIG. **3** and the building elevator configuration **250** of FIG. **4**. The building elevator configuration **200** includes an inaccessible region of floors **204** that prevent entrance/egress in the elevators of the first elevator group **92***a* at floors between the discharge floor **106** and the transfer floor **104**. The building elevator configuration **250** includes a first region of inaccessible floors **204***a* that prevents entrance/egress in the elevators of the first elevator group **92***a* at floors between a first transfer floor **104***a* (e.g., equivalent to the transfer floor **104** of FIG. **3**) and a second transfer floor **104***b,* and a second region of inaccessible floors **204***b* that prevents entrance/egress in the elevators of the first elevator group **92***a* at floors between the second transfer floor **104***b* and the discharge floor **106**. It will be understood that numerous other elevator groupings and configurations are contemplated. In the example of FIG. **4**, occupant transfers between the first elevator group **92***a* and the second elevator group **92***b* can occur at either the first transfer floor **104***a* or the second transfer floor **104***b*. The second elevator group **92***b* may also support an alternate discharge floor **210** that, for instance, may have access to outside of the building **102**, such as through a stairway, an escalator system, a sky bridge, or other such structure. The alternate discharge floor **210** may be preferred if there is an evacuation alarm **88***a* active or other such degraded condition detected at the discharge floor **106**. The alternate discharge floor **210** may be selected based on environmental or other current conditions such that the alternate discharge floor is selected for use as needed. Notably, in the example of FIG. **4**, the alternate discharge floor **210** is inaccessible from the first elevator group **92***a* due to alignment with the second region of inaccessible floors **204**.

[0033] When the second elevator group **92***b* is configured in an evacuation mode of operation to support evacuation through the first elevator group **92***a,* the transfer floor **104** becomes an evacuation discharge floor **206** of the first elevator group **92***a* and an evacuation floor **205** of the second elevator group **92***b*. Such an event could put the second elevator group **92***b* into evacuation even if it was not in evacuation initially. Similarly, if multiple transfer floors **104***a,* **104***b* are supported, when the second elevator group **92***b* is configured in an evacuation mode of operation to support evacuation through the first elevator group **92***a,* the first transfer floor **104***a* can be a first evacuation discharge floor **206***a* of the first elevator group **92***a* and a first evacuation floor **205***a* of the second elevator group **92***b*. Similarly, the second transfer floor **104***b* can be a second evacuation discharge floor **206***b* of the first elevator group **92***a* and a second evacuation floor **205***b* of the second elevator group **92***b*.

[0034] Referring now to FIG. **5**, while referencing components of FIGS. **1-4**, FIG. **5** shows a flow chart of method **300** of operating a building elevator system **100**, in accordance with an embodiment of the disclosure which may be used for various configurations, such as building elevator configurations **200**, **250**. The method **300** can include additional steps beyond those depicted in FIG. **5** and some steps may be performed in an alternate order.

[0035] At block **302**, the building elevator system **100** is under normal operation. Under normal operation, the control system **110** controls the first elevator group **92***a* and the second elevator group **92***b* according to normal dispatching priorities (e.g., non-evacuation mode). As mentioned above, the floor coverage of the first elevator group **92***a* overlaps the floor coverage of the second elevator group **92***b* by at least one transfer floor **104**, as seen in FIG. **2**. In the example of FIG. **2**, the transfer floor **104** is floor **80***d*. In the example of FIG. **4**, there are multiple transfer floors **104**, including a first transfer floor **104***a* and a second transfer floor **104***b,* in some configurations, such as the building elevator configuration **250**.

[0036] At block **304**, the control system **110** detects if an evacuation call has been received. At block **304**, based determining that an evacuation call is active for an evacuation floor **105** serviced by a first elevator group **92***a,* the method **300** continues to block **306**; otherwise, the method **300** returns to block **302**. At block **306**, the control system **110** sets a transfer floor **104** serviced by the first elevator group **92***a* as an evacuation discharge floor **206** of the first elevator group **92***a.*

[0037] At block **308**, the control system **110** requests a second elevator group **92***b* to enter an evacuation mode of operation, where the second elevator group **92***b* is operable to service the transfer floor **104** and a discharge floor **106**. Requesting the second elevator group **92***b* to enter the evacuation mode of operation can be performed based on determining that the first elevator group **92***a* is inhibited from traveling to the discharge floor **106**, for instance, based on a degraded hoistway condition. For example, the control system **110** can detect a sway condition of the first elevator group **92***a,* compare the sway condition to a sway limit, and determine that the first elevator group **92***a* is inhibited from traveling between the transfer floor **104** and the discharge floor **106** based on a result of comparing the sway condition to the sway limit. The sway limit can be defined in terms of a sway frequency and/or magnitude. For instance, if the resonant frequency of the first elevator group **92***a* would result in a risk of component contact as elevator cars **23***a*-**23***c* traverse between the evacuation floor **105** and the discharge floor **106**, then direct travel to the discharge floor **106** can be inhibited, resulting in a mode transition for the second elevator group **92***b* to enter the evacuation mode of operation even though no floors **80***a*-**80***d* directly serviced by the second elevator group **92***b* have a corresponding evacuation call. Other examples include detected seismic activity responsive to a seismic sensor, a counterweight misalignment condition, and other such conditions. The evacuation mode of operation can prioritize travel between the transfer floor **104** and the discharge floor **106** over one or more requests received from one or more elevator call buttons **89***b*-**89***c* between the transfer floor **104** and the discharge floor **106**. For example, rather than servicing elevator call requests between the transfer floor **104** and discharge floor **106**, the control system **110** stops at the transfer floor **104** or the discharge floor **106** while evacuation is active.

[0038] At block **310**, the control system **110** sets the transfer floor **104** as the evacuation floor **205** of the second elevator group **92***b*. The evacuation floor **105** serviced by the first elevator group **92***a* may be unreachable by the second elevator group **92***b*. At block **312**, the control system **110** coordinates control of the first elevator group **92***a* and the second elevator group **92***b* to evacuate one or more occupants from the evacuation floor **104** serviced by the first elevator group **92***a* to the discharge floor **106** serviced by the second elevator group **92***b*.

[0039] In embodiments, the control system **110** can monitor one or more conditions of the discharge floor **106**. For example, the discharge floor **106** can be monitored for fire, flooding, and/or other hazards using various sensors and detection techniques. The control system **110** can set the evacuation discharge floor of the second elevator group **92***b* to an alternate discharge floor **210** based on detecting one or more degraded conditions at the discharge floor **106**. The alternate discharge floor **210** may have an alternate exit from the building **102**. The control system **110** can restrict travel of the second elevator group **92***b* between the alternate discharge floor **210** and the discharge floor **106**, for instance, to prevent the degraded conditions from spreading to the alternate discharge floor **210**. Further, the multiple transfer floors **104***a*, **104***b* can enable changing the first evacuation discharge floor **206***a* of one or more elevator cars **23***a*-**23***c* of the first elevator group **92***a* to a second evacuation discharge floor **206***b* at a secondary transfer floor **104***b*

[0040] While the above description has described the flow process of FIG. **5** in a particular order, it should be appreciated that unless otherwise specifically required in the attached claims that the ordering of the steps may be varied.

[0041] As described above, embodiments can be in the form of processor-implemented processes and devices for practicing those processes, such as a processor. Embodiments can also be in the form of computer program code containing instructions embodied in tangible media (i.e., a computer program product), such as network cloud storage, SD cards, flash drives, floppy diskettes, CD ROMs, hard drives, or any other computer-readable storage medium, wherein, when the computer program code is loaded into and executed by a computer, the computer becomes a device for practicing the embodiments. Embodiments can also be in the form of computer program code, for example, whether stored in a storage medium, loaded into and/or executed by a computer, or transmitted over some transmission medium, loaded into and/or executed by a computer, or transmitted over some transmission medium, such as over electrical wiring or cabling, through fiber optics, or via electromagnetic radiation, wherein, when the computer program code is loaded into an executed by a computer, the computer becomes an device for practicing the embodiments. When implemented on a general-purpose microprocessor, the computer program code segments configure the microprocessor to create specific logic circuits.

[0042] The term "about" is intended to include the degree of error associated with measurement of the particular quantity based upon the equipment available at the time of filing the application. For example, "about" can include a range of ±8% or 5%, or 2% of a given value.

[0043] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, element components, and/or groups thereof.

[0044] While the present disclosure has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the present disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present disclosure without departing from the essential scope thereof. Therefore, it is intended that the present disclosure not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this present disclosure, but that the present disclosure will include all embodiments falling within the scope of the claims.

What is claimed is:

1. A method of operating a building elevator system, the method comprising:

determining that an evacuation call is active for an evacuation floor serviced by a first elevator group;

setting a transfer floor serviced by the first elevator group as an evacuation discharge floor of the first elevator group;

requesting a second elevator group to enter an evacuation mode of operation, the second elevator group operable to service the transfer floor and a discharge floor;

setting the transfer floor as the evacuation floor of the second elevator group; and

coordinating control of the first elevator group and the second elevator group to evacuate one or more occupants from the evacuation floor serviced by the first elevator group to the discharge floor serviced by the second elevator group.

2. The method of claim **1**, wherein the evacuation floor serviced by the first elevator group is unreachable by the second elevator group.

3. The method of claim **1**, wherein requesting the second elevator group to enter the evacuation mode of operation is performed based on determining that the first elevator group is inhibited from traveling to the discharge floor.

4. The method of claim **3**, wherein determining that the first elevator group is inhibited from traveling to the discharge floor is based on detecting a degraded hoistway condition.

5. The method of claim **1**, further comprising:

monitoring one or more conditions of the discharge floor;

setting the evacuation discharge floor of the second elevator group to an alternate discharge floor based on detecting one or more degraded conditions at the discharge floor; and

restricting travel of the second elevator group between the alternate discharge floor and the discharge floor.

6. The method of claim **1**, further comprising:

changing the evacuation discharge floor of one or more elevator cars of the first elevator group to a secondary transfer floor.

7. The method of claim **1**, wherein the evacuation mode of operation prioritizes travel between the transfer floor and the discharge floor over one or more requests received from one or more elevator call buttons between the transfer floor and the discharge.

8. A control system of a building elevator system, the control system comprising:

a processor; and

a memory comprising computer-executable instructions that, when executed by the processor, cause the processor to perform operations, the operations comprising:

determining that an evacuation call is active for an evacuation floor serviced by a first elevator group;

setting a transfer floor serviced by the first elevator group as an evacuation discharge floor of the first elevator group;

requesting a second elevator group to enter an evacuation mode of operation, the second elevator group operable to service the transfer floor and a discharge floor;

setting the transfer floor as the evacuation floor of the second elevator group; and

coordinating control of the first elevator group and the second elevator group to evacuate one or more occupants from the evacuation floor serviced by the first elevator group to the discharge floor serviced by the second elevator group.

9. The control system of claim **8**, wherein the evacuation floor serviced by the first elevator group is unreachable by the second elevator group.

10. The control system of claim **8**, wherein requesting the second elevator group to enter the evacuation mode of operation is performed based on determining that the first elevator group is inhibited from traveling to the discharge floor.

11. The control system of claim **10**, wherein determining that the first elevator group is inhibited from traveling to the discharge floor is based on detecting a degraded hoistway condition.

12. The control system of claim **8**, wherein the operations further comprise:

monitoring one or more conditions of the discharge floor;

setting the evacuation discharge floor of the second elevator group to an alternate discharge floor based on detecting one or more degraded conditions at the discharge floor; and

restricting travel of the second elevator group between the alternate discharge floor and the discharge floor.

13. The control system of claim **8**, wherein the operations further comprise:

changing the evacuation discharge floor of one or more elevator cars of the first elevator group to a secondary transfer floor.

14. The control system of claim **8**, wherein the evacuation mode of operation prioritizes travel between the transfer floor and the discharge floor over one or more requests received from one or more elevator call buttons between the transfer floor and the discharge.

15. A computer program product tangibly embodied on a computer readable medium, the computer program product including instructions that, when executed by a processor, cause the processor to perform operations comprising:

determining that an evacuation call is active for an evacuation floor serviced by a first elevator group;

setting a transfer floor serviced by the first elevator group as an evacuation discharge floor of the first elevator group;

requesting a second elevator group to enter an evacuation mode of operation, the second elevator group operable to service the transfer floor and a discharge floor;

setting the transfer floor as the evacuation floor of the second elevator group; and

coordinating control of the first elevator group and the second elevator group to evacuate one or more occupants from the evacuation floor serviced by the first elevator group to the discharge floor serviced by the second elevator group.

16. The computer program of claim **15**, wherein requesting the second elevator group to enter the evacuation mode of operation is performed based on determining that the first elevator group is inhibited from traveling to the discharge floor.

17. The computer program of claim **16**, wherein determining that the first elevator group is inhibited from traveling to the discharge floor is based on detecting a degraded hoistway condition.

18. The computer program of claim **15**, wherein the operations further comprise:

monitoring one or more conditions of the discharge floor;

setting the evacuation discharge floor of the second elevator group to an alternate discharge floor based on detecting one or more degraded conditions at the discharge floor; and

restricting travel of the second elevator group between the alternate discharge floor and the discharge floor.

19. The computer program of claim **15**, wherein the operations further comprise:

changing the evacuation discharge floor of one or more elevator cars of the first elevator group to a secondary transfer floor.

20. The computer program of claim **15**, wherein the evacuation mode of operation prioritizes travel between the transfer floor and the discharge floor over one or more requests received from one or more elevator call buttons between the transfer floor and the discharge.

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