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(54) STAIRLIFT SAFETY SYSTEM AND METHOD OF CONTROLLING OPERATION OF A STAIRLIFT SYSTEM

(57) The present invention relates to a stairlift system comprising a stairlift carriage (110), adapted to travel along a defined path (120), which comprises at least one sensor (198, 199) for detecting at least one physiological parameter of a user, and a controller (200) adapted to start and/or halt travel of the stairlift carriage (110) in dependence of the nature and/or a value of the at least one detected physiological parameter.

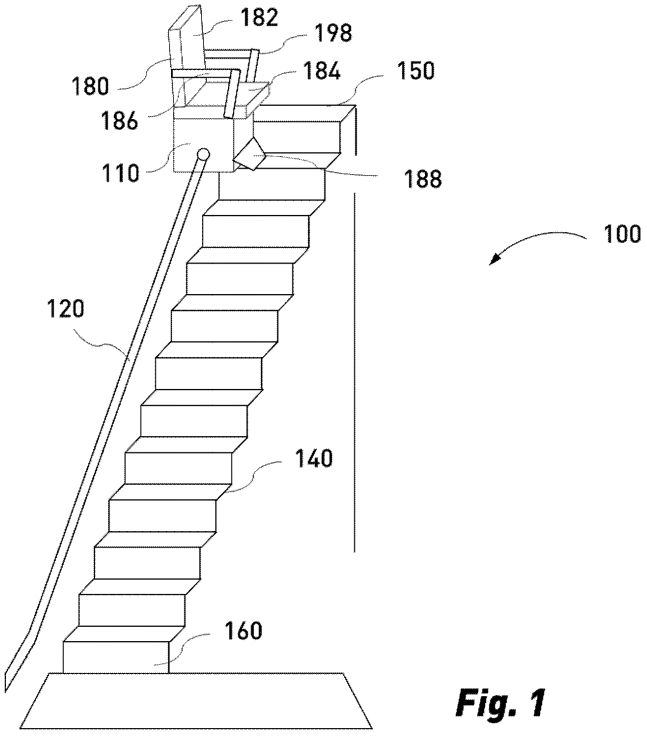

Fig. 1

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Description

[0001] The present invention relates to stairlifts, and a method of controlling their operation. The term stairlift system or stairlift shall comprise all kinds of stairlifts, such as for a seated or a standing user, or a platform lift for wheelchairs.

[0002] Prior art stairlifts utilize a number of safety features. These include for example a hand control (hold to run) for constant operation by the user. With such hand controls, a user must maintain a continuous pressure on the control to effect movement of the stairlift. This necessity of providing continuous pressure can cause discomfort to users, taking into account the potentially frail constitution of typical stairlift users, taking into account the potentially frail constitution of typical stairlift users.

[0003] On the other hand, it must be ensured that a carriage of a stairlift comes to a halt in case there is a danger for a user colliding with an obstruction in the path of the carriage. Such a danger arises if, for example, a user of a stairlift, for example seated on a carriage chair, leans with his/her arm too far out and gets stuck (squeezed) in between the wall and chair, with his/her arm too far out and gets stuck (squeezed) in between the wall and chair.

[0004] WO 2009/098480 A1 discloses a stairlift including a stairlift carriage and a defined path along which, in use, the carriage travels, the stairlift including a monitoring facility to monitor the path ahead of the moving carriage, and in the event the monitoring facility identifies an obstruction in the path, to cause the carriage to halt. Such a solution requires a multitude of sensing devices, such as cameras, sensors etc., and is difficult to implement due to the fact that stair cases, on which stairlifts are mounted, differ from each other, so that no standardized solutions can be used. Especially, there are numerous kinds of movements on the part of a user of a stairlift, which can lead to potential collisions with obstructions. In addition to the leaning forward movement as described above, it is referred to movements of hands, arms, feet or legs, which can lead to such dangerous collisions. Complex monitoring equipment raises production costs of stairlifts significantly, and requires a complicated and time consuming implementation and maintenance.

[0005] The present invention seeks to provide an enhanced control for stairlift systems, wherein safety requirements are adequately observed.

[0006] The invention suggests a stairlift system comprising the features of claim 1 and a method of controlling operation of a stairlift system comprising the features of claim 7.

[0007] The stairlift system according to the invention comprises a stairlift carriage adapted to travel along a defined path, and further comprises at least one sensor for detecting at least one physiological parameter of a user, and a controller adapted to start and/or halt travel of the stairlift carriage in dependence of the nature and/or a value of the at least one detected physiological parameter.

[0008] By detecting the nature and/or a value of suitable physiological parameters, potentially dangerous conditions of a user, such as unconsciousness, which can lead to unwanted movements of a user resulting in the danger of collisions, can be easily monitored. The necessary effort to provide sufficient safety for an user can thus effectively be reduced compared to prior art solutions, which require extensive monitoring of various body parts of a user and/or the path along which the stairlift carriage travels. Thus, a stairlift carriage can especially be halted in case of a potentially dangerous condition of a user. Also, it is possible to monitor the condition of a user before a stairlift carriage is set into motion, i.e. started. In case a potentially dangerous condition of a user is detected, a start can be prevented. The invention provides a highly effective elevator safety system.

[0009] Expediently, the at least one sensor for detecting a physiological parameter is mounted on the stairlift carriage. A sensor for monitoring cardiac activity can, for example, be mounted in or on an armrest of a chair provided on the stairlift carriage, where a user of the stairlift places a hand. This position allows an especially simple and reliable detection of heart rate.

[0010] It is also advantageously possible to provide the at least one sensor for detecting a physiological parameter in a stationary manner. For example, the sensor can be provided on a stationary component of the stairlift system, and/or in the vicinity of a staircase, on which the stairlift system is mounted. Such sensors are easily accessible for example by servicing personnel.

[0011] According to a preferred embodiment, the stairlift is provided with a sensor for detecting cardiac activity, especially a heart rate and/or the heart beat of a user. Such sensors, which can detect the heart rate or the heart beat even if they are located at a certain distance from the heart, for example up to 20 cm, 30 cm or even 50 cm or 1 m, are readily available For example, radar based sensing allows monitoring of heartbeat and respiration at a distance. They are capable of detecting a heart beat even in case of intermediate objects, such as a wall, plastic covers etc., between the sensor and the heart.

[0012] Other physiological parameters which can expediently be detected comprise, for example, blood pressure, body temperature, the depth and/or frequency of breathing and activity of the eyes or eyelids. Sensors for detecting the tidal volume as a measure for the depth for breathing or for measuring the frequency of breathing are readily available.

[0013] As further examples, it is referred to the sensing of pain, for example in case a user gets stuck between moving a stairlift carriage and an obstacle or staircase. A further example comprises sensing that a body part has moved into an unacceptable position so that the travelling of the stairlift along the predefined path can be interrupted or halted. For example, an injured and/or weak leg can move or drop off the footrest and get stuck in between the staircase and moving stairlift carriage.

[0014] Changes in cardiac activity can, for example, indicate an imminent or current heart attack or be a reaction to pain, which can lead to unconsciousness or a user no longer being able to control his body movements. Changes in frequency of breathing can, for example, indicate pain or fright regarding unexpected occurrence or even can indicate unconsciousness, due to various reasons. Similar observations are valid for eye or eyelid activity. A closed eyelid, for example, can indicate sleep or unconsciousness, which can lead to unwanted movements of the body of the stairlift user.

[0015] Expediently, the stairlift is provided with a device for issuing an acoustic and/or optical warning in case of a halt of the stairlift carriage in reaction to a detected physiological parameter. Such a warning device further enhances safety, as other people, for example helpers or nursing staff, in the vicinity of the stairlift can be informed of an incident. It is also possible to transmit such a warning to a remote location, for example a central monitoring unit.

[0016] The method according to the invention comprises the steps of detecting at least one physiological parameter of a user, and starting and/or halting travel of the stairlift carriage in dependence on the nature and/or a value of the at least one detected physiological parameter.

[0017] Expediently the at least one physiological parameter is detected continuously during a complete journey of a user between a starting point and an end point of the stairlift. With such a continuous detection of at least one physiological parameter, i.e. a monitoring, safety can be further enhanced.

[0018] According to a preferred embodiment, a travelling of the stairlift carriage is halted in case of an irregular physiological parameter, especially irregular cardiac activity, such as a heart rate of a user above or below a predetermined threshold is detected.

[0019] Preferably, the stairlift carriage is restarted after an incident of halting due to detection of at least one physiological parameter, in case of a corresponding manual command entered by the user of the stairlift or another person. This ensures that an automatic halting of the stairlift due to detection of a physiological parameter can be overridden, for example in case of a false detection of a physiological parameter or in case a person assisting the user of the stairlift can ensure safe travel.

[0020] The invention also provides a method for installing a stairlift system, comprising installing and adjusting at least one sensor for detecting at least one physiological parameter of a user on the stailift carriage or in a stationary manner, especially in the vicinity of a staircase, on which the stairlift system is mounted.

[0021] A preferred embodiment of the invention will now be described with reference to the drawings in which

Figure 1 shows a schematic perspective view of a stairlift, to which the present invention can be applied, and

Figure 2 shows a perspective view of a stairlift carriage comprising a chair, to which the present invention can be applied.

[0022] A stairlift, to which the invention can be applied, is generally designated 100. It includes a stairlift carriage 110, which is moveable along a defined path. The path is defined by a stairlift rail 120, which is provided on a staircase 140. The carriage comprises a drive motor 130, shown schematically in figure 2.

[0023] The carriage 110, which is provided with a chair 180, can travel along the rail 120 between a upper end 150 and a lower end 160 of the staircase. Expediently, the chair is provided with a back 182, a seat 184, two armrests 186 and a footrest 188.

[0024] The carriage 110 is provided with a sensor 198 for detecting the heart rate of a user of the stairlift. This sensor is especially shown in figure 2, which shows the carriage 110 and the chair 180 in greater detail.

[0025] The stairlift 100 is provided with a manually operable start and stop control 190, which must be activated to start or stop the carriage 110, for example by briefly displacing spherical element 191 from its equilibrium position. It must not be continuously operated. Be it noted that it is also possible to provide the control 190 in such a way that continuous operation (i.e. continuous exertion by the user) is necessary. The chair can further be provided with a safety belt 192, which is only partially shown in figure 2.

[0026] The sensor 198 for sensing a heart rate of a user is provided in at least one armrest 186. A typical position for sensor 198 on armrest 186 is schematically shown in an enlarged depiction of armrest 186 on the right side of figure 2. The sensor 198 can either be provided as a contact sensor, which senses the heart beat via the pulse of a user, who rests his arm on armrest 186. It can also be provided as a remote sensor in the drive unit, sensing physiological variances from a distance without physical contact to the user of the stairlift, which directly senses the heart beat of a user of carriage 110.

[0027] In addition to such a sensor 198 for sensing a heart rate, a further sensor for detecting a further physiological parameter can be provided, and for example be located under seat 184 (schematically indicated as 199 in figure 2).

[0028] With the stairlift according to the invention, cardiac activity such as a heart rate and additionally or alternatively, other expedient physiological parameters indicating a medical condition of the user of the stairlift, which can lead to e.g. sleep or unconsciousness, is or are easily detected, so that the stairlift carriage 110 can be efficiently controlled, especially instantly halted in case of such an occurrence.

[0029] The sensor data detected by sensor(s) 198 and/or 199 are expediently processed by a controller 200, provided for example under seat 184.

[0030] The controller 200 can especially issue a halt-command for drive motor 130.

[0031] Expediently, an acoustic and/or optical warning device 202 is provided. Device 202 can issue a corresponding optical or acoustical warning in case of a halt of the carriage 110 due to a command issued by controller 200 on the basis of a detected physiological parameter.

Claims

1. Stairlift system comprising a stairlift carriage (110), adapted to travel along a defined path (120), **characterized in that** it comprises at least one sensor (198, 199) for detecting at least one physiological parameter of a user, and a controller (200) adapted to start and/or halt travel of the stairlift carriage (110) in dependence of the nature and/or a value of the at least one detected physiological parameter.

2. Stairlift system according to claim 1, wherein the at least one sensor for detecting a physiological parameter is mounted on the stairlift carriage (110).

3. Stairlift safety system according to any one of the preceding claims, wherein the sensor is mounted in or on an armrest (186) of a chair (180) provided on the stairlift carriage (110).

4. Stairlift system according to claim 1, wherein the at least one sensor for detecting a physiological parameter is provided in a stationary manner.

5. Stairlift system according to any one oft the preceding claims, wherein the sensor (198) is provided as a sensor for detecting cardiac activity, especially heart rate and/or heart beat of a user.

6. Stairlift system according to any one of the preceding claims, wherein the sensor (199) is provided as a sensor for detecting depth and/or frequency of breathing or as a sensor for detecting blood pressure or as a sensor for detecting body temperature.

7. Stairlift system according to any one of the preceding claims, further comprising a device (202) for issuing an acoustic and/or optical warning in case of a halt of the stairlift carriage (110) in reaction to a detected physiological parameter.

8. Method of controlling operation of a stairlift system with a stairlift carriage (110) traveling along a defined path (120), comprising the steps of

   - detecting at least one physiological parameter of a user and,
   - starting and/or halting travel of the stairlift carriage (110) in dependence on the nature and/or a value of the at least one detected physiological parameter.

9. Method according to claim 8, wherein cardiac activity, especially heart beat or heart rate, of the user is detected as a physiological parameter.

10. Method according to claim 8 or 9, wherein depth and/or frequency of breathing or blood pressure or body temperature of the user is detected as a physiological parameter.

11. Method according to any one of claims 8 to 10, wherein the at least one physiological parameter is detected continuously during a complete journey of a user between a starting point and an end point of the stairlift carriage (110).

12. Method according to any one of claims 8 to 11, wherein a traveling stairlift carriage (110) is halted in case an irregular physiological parameter, especially irregular cardiac activity of the user, being detected.

13. Method according to any one of the preceding claims 8 to 12, wherein the stairlift carriage(110) is restarted after an incident of halting due to detection of at least one physiological parameter in case of a manual command entered by the user or another person.

14. Method of installing a stairlift safety system according to any one of preceding claim 1 to 7, comprising the step of installing and adjusting at least one sensor for detecting at least one physiological parameter of a user on the stairlift carriage or in a stationary manner, especially in the vicinity of a staircase on which the stairlift system is mounted.

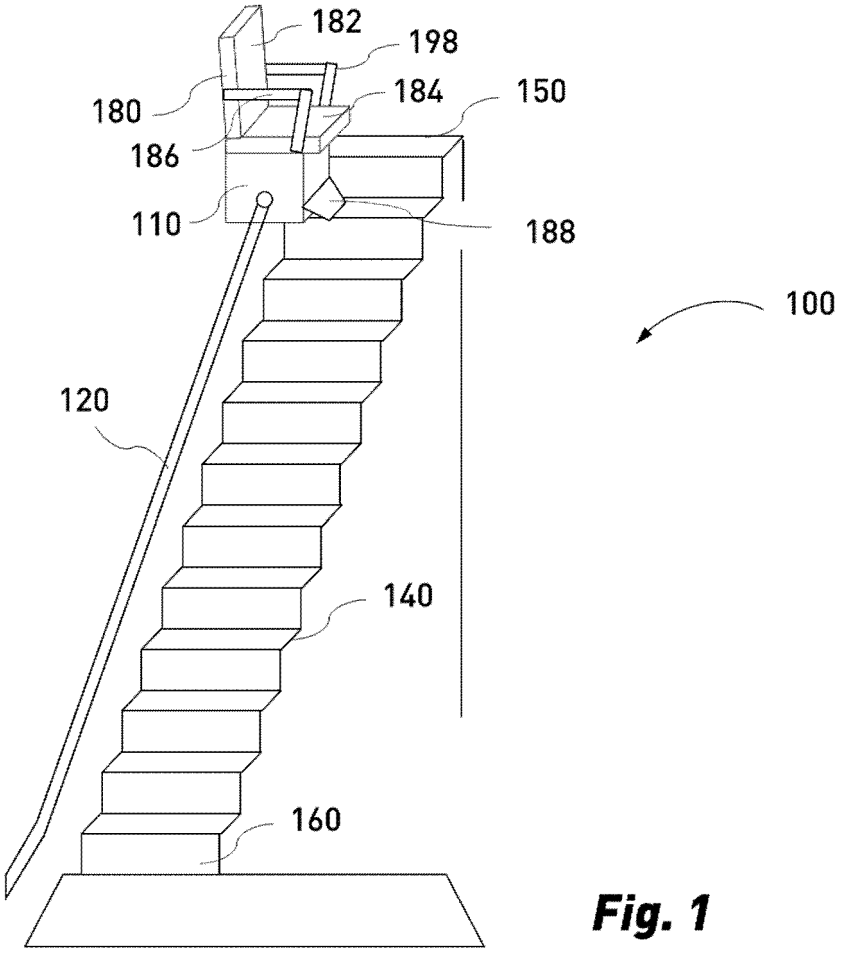

Fig. 1

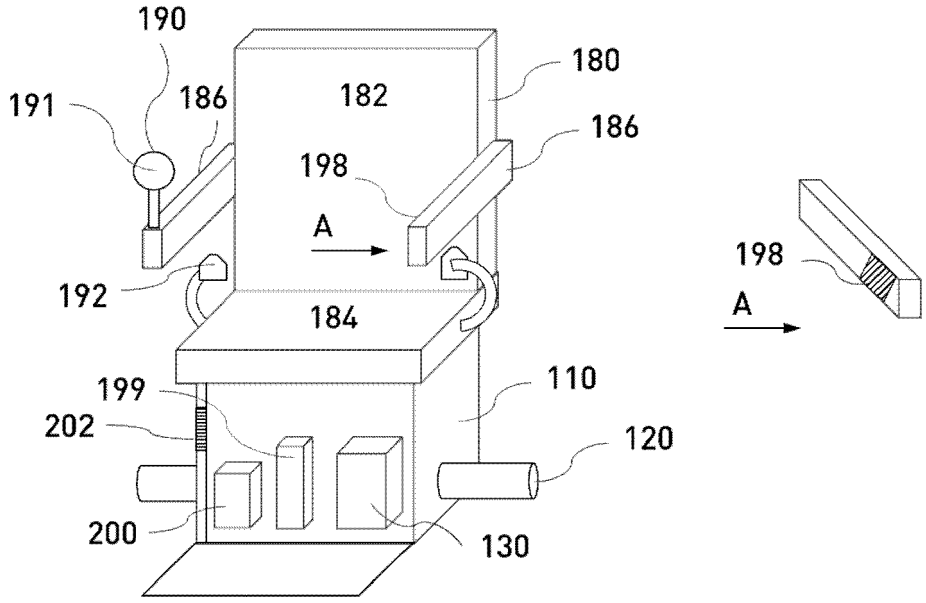
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Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 7349

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	US 7 185 741 B1 (ROZENFELD YAKOV [US]) 6 March 2007 (2007-03-06) * abstract; figures 1,6 * -----	1,2,4,8, 11,12,14 3,5,6,9, 10 7,13	INV. B66B9/08
Y	GB 2 511 630 A (ACORN MOBILITY SERVICES LTD [GB]) 10 September 2014 (2014-09-10) * abstract * -----	3,5,6,9, 10	
A	US 2 985 257 A (JACKSON FLOYD H) 23 May 1961 (1961-05-23) * column 6, lines 54-62 * -----	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 June 2016	Janssens, Gerd

CATEGORY OF CITED DOCUMENTS

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7185741 B1	06-03-2007	NONE	
GB 2511630 A	10-09-2014	AU 2014210894 A1	06-08-2015
		CA 2898367 A1	07-08-2014
		EP 2951097 A1	09-12-2015
		GB 2511630 A	10-09-2014
		US 2015375961 A1	31-12-2015
		WO 2014118564 A1	07-08-2014
US 2985257 A	23-05-1961	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2009098480 A1 **[0004]**