

SAFETY DEVICE OF AN ELEVATOR SYSTEM

Description

The invention relates to a method of monitoring the movement of a lift cage and to safety equipment for carrying out the method.

A lift installation is installed in a building or attached thereto. It essentially consists of a cage which is connected by way of support means with a counterweight or with a second cage. The cage is moved along substantially vertical guide rails by means of a drive which acts selectably on the support means or directly on the cage or counterweight. The lift installation is used for transporting persons and goods within the building over single or several storeys.

The lift installation comprises devices for safeguarding the lift cage in the case of failure of the drive, support means or other lift components. These safeguards usually include a number of safety measures. A first safety measure is, for example, switching-off of the lift drive and actuation of drive brakes in order to stop the lift cage. This is usually carried out by interruption of a lift safety circuit. A further safety measure comprises activation of safety-brake devices or corresponding safety brakes. These can, when required, brake the lift cage on the guide rails or at brake rails. The safety measures are these days increasingly controlled by so-called electronic limiters which monitor movements of the lift cage.

A method for secure detection of movement states of a lift installation is known from EP 1602610. In that case, several movement variables are detected at different locations and compared with one another and multi-stage braking measures are initiated if impermissible deviations are ascertained.

Monitoring equipment is known from a further publication WO2010/107409, wherein a cleaned or filtered speed signal is calculated from a combination of speed measurement and acceleration measurement.

Similar monitoring equipment is known from JP2009/023823, wherein a cleaned speed signal is calculated from a combination of travel distance measurement and acceleration

measurement. In that case, an integrator calculates speed changes between measuring points of the travel distance meter. The speeds determined from the data of the travel distance meter and speed change calculated by the integrator are added and a reset logic sets the integrator to zero on each occasion when, for example, the travel distance meter registers a measuring point.

The invention has the object of providing an alternative method and corresponding safety equipment for monitoring the movement of a lift cage, wherein a high level of reliability and security of the generated signal are to be achieved.

The solutions described in the following enable secure, rapid-reaction and reliable monitoring of the movement of a lift cage. Safety measures can be carried out rapidly in the case of an emergency.

According to one aspect of the invention the safety equipment for monitoring the movement of a lift cage detects, preferably by means of a first movement sensor, an acceleration of the lift cage and, preferably by means of a second movement sensor, a travel speed or travel distance of the lift cage. The user has various possibilities for detection of the second movement variable. In the case of use of a first movement sensor in the form of a tachometer use is usually made of a generator which, for example, is driven by a friction wheel moved along the guide rails together with the lift cage. A tachometer of that kind generates an electrical signal which is proportional to the rotational speed and thus to the travel speed and which can be converted by a converter into, preferably, a digital signal of the travel speed of the lift cage. In the case of use of a first movement sensor in the form of an incremental transmitter or other travel-based sensor system a corresponding signal of the travel speed of the lift cage is derived from the detected travel increments.

Moreover, the safety equipment determines, preferably in an integration routine, an integrated travel speed from the acceleration, which is detected by the first movement sensor, of the lift cage, wherein the travel speed detected or derived by the second movement sensor is used as a start variable of an integration cycle of the integration routine. Thus, on the one hand use is made of two different kinds of sensors for detecting the travel speed, which enables good mutual verification of the result, and on the other hand compensation is provided for, for example, a possible drift of the first movement

sensor which detects the acceleration.

In addition, the integrated travel speed is now compared, preferably in a first monitoring module, with at least one predetermined limit speed and if the predetermined limit speed is exceeded one or more downstream safety measures are triggered.

Thus, a rapid and reliable method and system for monitoring the movement of the lift cage are provided. Reliable because the movement variables can be detected redundantly by different detection methods and rapid because by means of the detected acceleration a system, which is independent of slip and travel increment, for providing an integrated travel speed is present. Slip and travel increments lead, particularly in the case of rapid changes in movement, to values which are inaccurate and delayed in time.

In a preferred solution variant the integrated travel speed is compared, preferably in a first comparison routine, with the detected or derived travel speed and a new integration cycle is started, with use of the detected or derived travel speed, if a difference between the two travel speeds exceeds a first difference limit value or if a duration of the current integration cycle exceeds a predetermined time period. This comparison is carried out sporadically at relatively large intervals in time of, for example, up to one second and the first difference limit value is set to be generous.

For preference, a warning measure or safety measure is triggered if a difference between the two travel speeds exceeds a warning limit value or if a time plot of the difference between the two travel speeds exceeds an alarm value.

Small deviations between two different forms of detection are normal. Thus, considered over a longer time or a longer travel distance the detection result of a tachometer or an incremental transmitter is reliable, whilst rapid changes by detection of an acceleration can be recognised reliably. Thus, by the present solution it is possible to reliably provide compensation for, for example, drift of an acceleration sensor and at the same time rapid changes can also be reliably recognised.

In a preferred variant of solution, in addition a second acceleration of the lift cage is derived from the detected or derived travel speed of the lift cage and this second acceleration is compared, preferably in a second comparison routine, with the detected

acceleration. In the case of agreement of the two accelerations an OK signal is generated and the OK signal is used for releasing the further integration of the integration routine. On the other hand, the safety measure is triggered if a difference between these two accelerations exceeds a defined acceleration difference limit value or if the OK signal is not issued. This comparison is preferably carried out frequently, for example at an interval of approximately 10 milliseconds, and the acceleration difference value for comparison of the two accelerations is calculated to be narrow. Obviously, the difference limit values and also the other limit values are fixed with consideration of the characteristics and measuring accuracies of the sensors present as well as of the lift installation itself.

Overall, with this construction the quality and correctness of the signals and of the derivation routines are verified and thus the reliability and security of the monitoring system improved.

In a preferred variant of solution the acceleration detected by the first movement sensor is compared, preferably in a further, third comparison routine, with the second acceleration, which is derived from the detected or derived travel speed of the lift cage, of the lift cage in mirror image to the second comparison routine. In this case as well the safety measure is triggered if the difference between these two accelerations exceeds the defined acceleration difference limit value. This comparison is also frequently carried out in parallel with the second comparison routine and the acceleration difference limit value to the comparison of the two accelerations is similarly calculated to be narrow. These limit values are also fixed with consideration of the characteristics and measuring accuracy of the sensors present and the lift installation itself, wherein for preference use is made of the same limit values as used in the second comparison routine.

The two routines, i.e. the second and the third comparison routines, preferably take place in synchronism. Consequently, in the case of correct functioning of the comparison routines the result of the comparison should be substantially identical. These comparison values can thus be checked for equality in a supplementary assessment, wherein obviously if equality is absent appropriate safety measures or servicing requirements can be undertaken.

The safety equipment for monitoring the movement of the lift cage preferably comprises at least one first processor unit and second processor unit and the sensors, comparison

routines, monitoring modules and computing routines are apportioned to the two processor units. Thus, for example, the first movement sensor for detection of the acceleration, the integration routine, the first monitoring module and if need be the first and second comparison routines are executed as a component of the first processor unit or as functional groups with respect to the first processor unit. The second movement sensor for detecting the travel speed or the travel distance of the lift cage, possible computing routines and differentiators as well as, if need be, the third comparison routine are executed as a component of the second processor unit or as functional groups with respect to the second processor unit. A high level of reliability of the safety equipment is achievable with an architecture of separate processor units for processing and independent parallel evaluation of the detected signals of the at least two movement sensor, since the processor units can initiate possible safety measures independently of one another.

The safety equipment preferably comprises a second monitoring module, which compares the travel speed, which is detected or derived by the second movement sensor, with at least one predetermined limit speed and which triggers the safety measure if the predetermined limit speed is exceeded. This second monitoring module is preferably associated with the second processor unit. The travel speed of the lift cage is thus separately monitored twice, whereby overall safety is increased.

The safety equipment preferably comprises a fourth comparison routine, which compares the travel speed, which is detected or derived by the second movement sensor, with the travel speed integrated by the integration routine and which triggers a warning measure or safety measure if the difference between the two travel speeds exceeds the warning limit value or if a time plot of the difference between the two travel speeds exceeds an alarm value. This fourth comparison routine is preferably associated with the second processor unit. Thus, the quality of the safety equipment is in addition redundantly monitored in the two processor units and overall safety is correspondingly improved. Analogously to the first comparison routine, the comparison of the fourth comparison routine is also carried out sporadically at relatively large intervals in time and the associated first difference limit value is set to be generous. The fourth comparison routine is thus the comparison element redundant with respect to the first comparison routine.

The safety equipment preferably comprises a third monitoring module, which compares

the acceleration, which is detected by the first movement sensor, of the lift cage with at least one predetermined limit acceleration and which triggers a safety measure if a predetermined limit acceleration is exceeded. This third monitoring module is preferably associated with the first processor unit. A serious fault in the lift is directly and rapidly recognised by this third monitoring module if, for example, a high acceleration suddenly arises in the case of failure of support means. A braking measure can thus take place rapidly in the event of a fault of that kind.

The safety equipment can preferably trigger at least two different safety measures, wherein a first safety measure causes interruption of a lift safety circuit and a second safety measure causes actuation of a safety-brake device of the lift cage. The lift safety circuit is a central functional chain, which has to be intact or closed for movement of the lift cage, in the lift installation. Thus, the lift safety circuit is, for example, opened if a shaft door is opened. Interruption in the lift safety circuit has the effect that a drive of the lift installation is stopped and appropriate drive brakes are brought into action. Insofar as the safety equipment now ascertains an unusual deviation in the course of movement or a function of the safety equipment is no longer guaranteed, in the usual case as a first safety measure this lift safety circuit is interrupted and thus the lift installation stopped. If the deviation in the course of movement further increases notwithstanding the first safety measure or the deviations are very large then as a rule - as a second safety measure - safety brakes are actuated which firmly clamp the lift cage directly to guide rails and thus securely brake and hold the lift cage. The safety brakes are usually controlled by a brake control. Actuation of the safety brakes in these cases takes place by way of this brake control.

The second movement sensor of the safety equipment is preferably arranged in the region of a lift cage roller, preferably in the region of a support means deflecting roller arranged on the cage, and is driven by this. The travel speed or the travel distance of the lift cage can thus be accurately detected from a rotational movement of the lift cage roller or the support means deflecting roller. Lift cage rollers or also support means deflecting rollers are incorporated in the support structure of the lift cage. In that case, the load on the roller is of such a magnitude that slip is reduced and at the same time a fault in the support structure also leads, with a high level of probability, to influencing of the movement variable detected by the second movement sensor. This is reliably recognised by the aforesaid comparison routine and requisite safety measures can thus be initiated.

The safety equipment preferably comprises first safety equipment and second safety equipment, wherein the two items of safety equipment are constructed as explained in the foregoing embodiments. The first safety equipment is in that case preferably arranged in the region of a first support means deflecting roller of the lift cage and the second safety equipment is arranged in the region of a second support means deflecting roller of the lift cage. Overall safety is thus substantially increased, since, in total, use is made of two movement sensors for detection of the acceleration of the lift cage and for detection of the travel speed or the travel distance and are compared with one another and evaluated.

Exemplifying embodiments are explained in the following by way of examples and schematic constructions, wherein:

Fig. 1 shows a schematic view of a lift installation in side view,

Fig. 2 shows a schematic view of the lift installation in cross-section,

Fig. 3 shows a first embodiment of safety equipment,

Fig. 4 shows a second embodiment of enlarged safety equipment and

Fig. 5 shows a third embodiment of enlarged safety equipment.

The same reference numerals are used in the figures for equivalent parts over all figures.

A lift installation 1 is, as apparent in Fig. 1, installed in or attached to a building and serves for the transport of persons or goods within the building. The lift installation comprises a lift cage 2, which can move upwardly and downwardly along guide rails 7. A drive 6 serves for driving and holding the lift cage 2. The drive 6 is, for example, arranged in the upper region of the building and the cage 2 hangs by support means 4, for example support cables or support belts, at the drive 6 or at drive pulleys 6.2 of the drive 6. The support means 4 are guided by way of the drive pulleys 6.2 to a counterweight 3. A drive motor 6.1 of the drive 6 drives the drive pulleys 6.2 and thereby the support means 4 and thus the lift cage 2 and the counterweight 3. A drive brake 6.3 brakes, when required, the drive pulleys 6.2 or holds them in a rest position. The drive 6 can obviously also be

arranged in a different location in the building or in the region of the cage 2 or the counterweight 3.

In the present example the support means 4 are guided by way of support means deflecting rollers 5 of the lift cage 2. The lift cage 2 and - obviously - correspondingly also the counterweight 3 are suspended and driven in 2:1 relationship. A movement sensor 14 for detecting a travel speed or a travel distance of the lift cage is arranged at or in at least one of the support means deflecting rollers 5. The signals of the movement sensor 14 are passed on to safety equipment 12.

The lift installation 1 is controlled by a lift control 11. The lift control 11 receives user requests, optimises the operating sequence of the lift installation and controls, usually by way of a drive control 10, the drive 6. The lift control 11 or the drive control 10 additionally monitors the safety state of the lift installation and interrupts travel operation if an unsafe operating state arises. This monitoring is usually carried out with use of a lift safety circuit 28, in which all safety-relevant functions are incorporated. Also included in the monitoring of that kind or in this lift safety circuit are, for example, shaft door contacts which monitor correct closing of the shaft doors and there is also monitoring of, for example, limit positions of the travel body 2, 3 in the lift shaft. Interruption of the lift safety circuit 28 causes switching-off of the drive motor 6.1 and actuation of the drive brake 6.3, whereby the lift installation 1 is usually, i.e. in the case of correct functioning of the supporting and drive system, stopped.

The lift cage 2 and, if required, also the counterweight 3 are additionally equipped with a brake system, which is suitable for securing and/or retarding the lift cage 2 or the counterweight 3, respectively, in the case of unexpected movement or excess speed, even in the case of failure of the supporting and drive system. The brake system comprises, in the example, two identical safety brakes or safety-brake devices 8 which are attached to the lift cage 2 or the counterweight 3 on both sides thereof. The safety-brake devices 8 are, in the example, arranged underneath the lift cage 2 and are electrically activated by way of a brake control 9. This brake control 9 is connected with the safety equipment 12 of the lift installation, which monitors the movement of the lift cage 2 or the counterweight 3 and, if required, causes actuation of the safety-brake devices 8 or interrupts the lift safety circuit 28. The brake control 9 and the safety equipment 12 can be separate components, but they can obviously also be combined into a functional group or even integrated into a

lift or drive control 11, 10. A mechanical speed limiter, as is usually employed, can be eliminated, since the safety equipment 12 takes over this task. In the case of appropriate design of the safety-brake device 8, for example by redundant brake circuits, appropriate control algorithms and reset functions the drive brake 6.3 can possibly be eliminated and the lift safety circuit 28 can directly act on the brake control 9.

Fig. 2 shows the lift installation of Fig. 1 in a schematic plan view. The brake system comprises the two safety-brake devices 8. The two safety-brake devices 8 are electrically or mechanically coupled so that the two safety-brake devices 8 are actuated together. Unintended braking or safety-braking on one side is thus avoided. The two safety-brake devices 8 are preferably of identical or mirror-symmetrical construction and they act on the guide rails 7 arranged on either side of the cage 2.

The safety equipment 12, which monitors the movement of the lift cage, includes in a first embodiment, as illustrated in Figure 3, a first movement sensor 13 for detecting an acceleration AS of the lift cage 2. This first movement sensor 13 is arranged at the lift cage 2 or fastened thereto so that it can detect at least the accelerations of the lift cage in vertical direction. An integration routine 15 calculates from this acceleration an integrated travel speed VS, wherein obviously the acceleration is corrected by the amount of gravitational acceleration.

In addition, the safety equipment 12 includes a second movement sensor 14, which with reference to Figure 1 is attached to one of the support means deflecting rollers 5 and which, in one embodiment, detects angular movements of the support means deflecting roller 5 by means of an incremental counter 14.2. With knowledge of the roll diameter of the support means deflecting roller 5 a travel distance SM is detected therefrom and from this travel distance SM a travel speed VM is derived by means of a distance differential computer 14.3. Alternatively, instead of the incremental counter 14.2 and the distance differential computer 14.3 use can be made of a tachometer 14.1 which directly detects the travel speed VM, as illustrated by dashed lines in Figure 3. In addition, a differential routine 17 calculates a derived acceleration AM from the travel speed VM detected or derived by the second movement sensor 14.

The signals of acceleration sensors, such as used for detecting accelerations of the lift cage 2, have small inaccuracies attributable to the system. This leads by way of the

integration to summation of these inaccuracies, which over a longer period of time leads to falsification of the result. In order to compensate for these inaccuracies or drift a new integration cycle, with use of the travel speed VM detected by the second movement sensor as a start variable, is started at an interval in time if specific travel events occur or if a difference dV between the travel speed VM detected by the second movement sensor and the travel speed VS integrated by the first movement sensor exceeds a defined amount. For that purpose, a reset logic 16 is added to the integration routine 15. The reset logic 16 controls the integration sequence of the integration routine 15 and supplies the travel speed VM, which is detected by the second movement sensor 14, on each occasion as start variable of an integration cycle. In the embodiment of Figure 3 for that purpose a first comparison routine 21 compares the integrated travel speed VS of the first movement sensor 13 with the detected travel speed VM and generates a warning signal R1 at the reset logic 16 if a difference dV between the two travel speeds VS, VM exceeds a predetermined value of, for example, approximately 5% of a nominal speed. As soon as this warning level R1 is present at the reset logic 16 a new integration cycle is started, wherein then the travel speed VM detected by the second movement sensor is set as start variable of the new integration cycle. Continuous compensation is thus in principle provided for drift.

The comparison routine 21 in that case operates at long intervals in time of, for example, approximately 500 milliseconds. If the comparison routine 21 now establishes that the difference dV within this period of time is large, for example more than 10% of the nominal speed, a safety measure 27 is triggered. In a first step the lift safety circuit 28 is thereby interrupted and thus the lift installation stopped. If the difference dV within this period of time is even larger, for example more than 15% of the nominal speed, a brake control 9 for activation of the safety-brake devices is directly activated.

In addition to the first comparison routine 21 a second comparison routine 22 checks correct functioning of the first and second movement sensors 13, 14 in that it compares the acceleration AM derived from the second movement sensor 14 with the acceleration AS detected by the first movement sensor 13 and obviously cleaned with respect to gravitational acceleration. This second comparison routine 22 operates, by contrast to the first comparison routine 21, at high cyclic frequencies. An operating time interval of the second comparison routine 22 is, for example, approximately 10 milliseconds. As long as the second comparison routine establishes approximate agreement of the two

accelerations AM, AS an OK signal R2 is issued at the reset logic 16. This has the effect that the integration routine 15 is continued. If the two accelerations AM, AS significantly differ from one another the OK signal is stopped, whereupon the reset logic 16 uses the respective greater one of the two travel speeds VS, VM for a possible new integration cycle. At the same time the safety measure 27 is selectively initiated in that depending on the size of the difference between the two accelerations AM, AS merely the lift safety circuit 28 is interrupted or, possibly with a delay in time, the brake control 9 is activated.

The values indicated in the examples are merely by way of example. The time values, difference values and other values can be established in dependence on sensors used, travel speed, etc.

In addition, the safety equipment according to Figure 3 includes a first monitoring module 18, which compares the integrated travel speed AS with a permissible limit speed VG and triggers the safety measure 27 if the permissible limit speed VG is exceeded. Usually, as a first safety measure 27 the lift safety circuit 28 is interrupted if the so-called nominal speed of the lift installation is exceeded by approximately 10% or the safety-brake device 8 is actuated if the nominal speed is exceeded by more than 15%.

Thus, the functioning of the two movement sensors is checked and monitored by means of comparison of the accelerations AM, AS, compensation for drift of the integrated travel speed VS is provided by means of sporadic comparison of the travel speeds VM, VS and functioning of computation routines is checked. The travel speed of the lift cage can thus be reliably monitored.

In the example, the calculation routines 15, 17, 14.3, the comparison routines 21, 22 and the monitoring module 18 are arranged on a circuitboard or on a processor unit 25. In addition, the first movement sensor 13 can also be a component of this processor unit 25 and the entire safety equipment 12 can be arranged in the region of support means deflecting rollers 5 (see Figures 1 and 2). The arrangements can obviously also be selected to be different. Thus, by way of example, the second movement sensor 14 together with the differential routine 17 can form a processor unit and the remaining components such as integration routine 15, the comparison routines 21, 22 and the monitoring module 18 can be combined in another processor unit.

In a further embodiment, as is illustrated in Figure 4, the safety equipment 12 comprises, in addition to the safety equipment explained in the preceding, a second monitoring module 19 which compares the travel speed VM, which is detected or derived by the second movement sensor 14, with an allowable limit speed VG2 and, analogously to the first monitoring module 18, triggers the safety measure 27 if the allowable limit speed is exceeded. As a rule, the permissible limit speed VG2 is set to be identical with the limit speed VG. In addition, the safety equipment 12 includes a fourth comparison routine 24, which in partial analogy to the first comparison routine 21 compares the travel speed VM detected or derived by the second movement sensor 14 with the integrated travel speed VS of the first movement sensor 13. This fourth comparison routine 24 similarly triggers, like the first comparison routine 21, a safety measure 27 if the difference within a set time interval is large.

In this embodiment the integration routine 15 with associated reset logic 16, the first and second comparison routines 21, 22 and the monitoring module 18 are arranged on a first processor unit 25. This first processor unit 25 is associated with the first movement sensor 13 or the first movement sensor 13 is integrated in the first processor unit 25. The remaining subassemblies such as the differential routine 17, the monitoring module 19 and the fourth comparison routine 24 are arranged on a second processor unit 26 in connection with the distance sensor 14.2 and the distance differentiator 14.3 or the speed tachometer 14.1. The security of this safety equipment with two processor units 25, 26 is particularly reliable, since important functions are processed in redundant manner and the two processor units 25, 26 can initiate safety measures 27 independently of one another.

A further embodiment, as illustrated in Figure 5, further includes, additionally by comparison with the preceding embodiments, a third monitoring module 20, which is arranged at the first processor unit 25 and which compares the acceleration AS, which is detected by the first movement sensor 13, of the lift cage with at least one predetermined limit acceleration AG and triggers a safety measure 27 if the predetermined limit acceleration AG is exceeded. This third monitoring module 20 is provided primarily for the purpose of rapidly detecting a possible freefall or crashing down of a lift cage.

Moreover, provided in this embodiment is a third comparison routine 23 which is arranged at the second processor unit 26 and which analogously to the second comparison routine 22 checks correct functioning of the first and second movement sensors 13, 14 in that it

compares the acceleration AS, which is detected by the first movement sensor 13 and obviously cleaned with respect to gravitational acceleration, with the acceleration AM derived from the second movement sensor 14 and triggers possible safety measures if the comparison reveals excessive deviations.

The illustrated embodiments can be varied by the expert. Depending on the required safety level, redundant comparison routines 23, 24 or the redundant monitoring module 19 can be omitted. The entire safety equipment 12 can possibly be duplicated in one of the embodiments or a variation thereof so that one safety equipment is arranged at a first support means deflecting roller 5.1 and a second safety equipment is arranged at a second support means deflecting roller 5.2. Safety of the entire installation is improved by this redundant arrangement. In addition, instead of the incremental sensors or tachogenerators mentioned in the embodiments use can obviously also be made of absolute position systems or other travel measuring systems. The method and the safety equipment are illustrated and explained in the embodiments in the application with respect to monitoring the movements of the lift cage. The method or equipment can obviously also be used in the same mode and manner at the counterweight.

Patent claims

1. Method of monitoring the movement of a lift cage, comprising the steps:
 - detecting an acceleration (AS) of the lift cage,
 - detecting a travel speed (VM) or a travel distance (SM) of the lift cage, wherein if required, when the travel distance (SM) of the lift cage is detected, the travel speed (VM) is derived from the detected travel distance (SM) of the lift cage,
 characterised in that
 - a second acceleration (AM) of the lift cage is derived from the detected or derived travel speed (VM) of the lift cage and
 - the detected acceleration (AS) is compared with the second acceleration (AM) derived from the detected or derived travel speed (VM) of the lift cage and if there is agreement of the two accelerations (AS, AM) an OK signal (R2) is generated and this OK signal is used for releasing a further integration or wherein a safety measure (27) is triggered if the difference (dA) between the detected acceleration (AS) and the second acceleration (AM) exceeds an acceleration difference limit value or if the OK signal is not issued.

2. Method of monitoring the movement of the lift cage according to claim 1, comprising the steps:
 - comparing the detected acceleration (AS) of the lift cage with at least one predetermined limit acceleration (AG) and
 - triggering the safety measure (27) if the detected acceleration (AS) exceeds the predetermined limit acceleration.

3. Method of monitoring the movement of the lift cage according to claim 1, comprising the steps:
 - determining an integrated travel speed (VS) by integration of the detected acceleration (AS) of the lift cage, wherein the detected or derived travel speed (VM) is used as a start variable of an integration cycle and
 - comparing the integrated travel speed (VS) with at least one predetermined limit speed (VG) and triggering a safety measure (27) if exceeding of the predetermined limit speed (VG) is established.

4. Method of monitoring the movement of a lift cage, comprising the steps:

- detecting an acceleration (AS) of the lift cage,
- detecting a travel speed (VM) or a travel distance (SM) of the lift cage, wherein if required, when the travel distance (SM) of the lift cage is detected, the travel speed (VM) is derived from the detected travel distance (SM) of the lift cage,
- determining an integrated travel speed (VS) by integration of the detected acceleration (AS) of the lift cage, wherein the detected or derived travel speed (VM) is used as a start variable of an integration cycle and
- comparing the integrated travel speed (VS) with at least one predetermined limit speed (VG) and triggering a safety measure (27) if exceeding of the predetermined limit speed (VG) is established.

5. Method according to claim 4, wherein the integrated travel speed (VS) is compared with the detected or derived travel speed (VM) and a new integration cycle is started if the difference (dV) between the integrated travel speed (VS) and the detected or derived travel speed (VM) exceeds a first difference limit value or if the duration of the current integration cycle exceeds a predetermined time period.

6. Method according to claim 4 or 5, wherein the integrated travel speed (VS) is compared with the detected or derived travel speed (VM) and a warning measure or safety measure (27) is triggered

- if a difference between the integrated travel speed (VS) and the detected or derived travel speed (VM) exceeds a warning limit value and/or
- if a time plot of the difference between the integrated travel speed (VS) and the detected or derived travel speed (VM) exceeds an alarm value.

7. Safety equipment (12) of a lift installation (1) for monitoring the movement of the lift cage (2), comprising:

- a first movement sensor (13) for detecting the acceleration (AS) of the lift cage (2),
- a second movement sensor (14, 14.1, 14.2) for detecting the travel speed (VM) or the travel distance (SM) of the lift cage (2), wherein if required, when the travel distance (SM) of the lift cage (2) is detected, the travel speed (VM) is derived from the travel distance (SM), which is detected by the second movement sensor (14.2), of the lift cage (2),

characterised in that

- a second acceleration (AM) of the lift cage (2) is derived from the detected or

derived travel speed (VM) of the lift cage,

- a comparison routine (22) for comparing the acceleration (AS) with the second acceleration (AM) compares the acceleration (AS) detected by the first movement sensor (13) with the second acceleration (AM) derived from the second movement sensor (14) and if the two accelerations (AS, AM) are in agreement generates an OK signal (R2) and

that a first integration routine (15) uses the OK signal for release or continuation of an integration or that safety equipment (12) triggers a safety measure (27) if a difference (dA) between the two accelerations (AS, AM) exceeds an acceleration difference limit value or if the OK signal (R2) is not issued.

8. Safety equipment (12) according to claim 7, wherein

- the integration routine (15) determines an integrated travel speed (VS) from the acceleration (AS), which is detected by the first movement sensor (13), of the lift cage (2), wherein the integration routine (15) uses the travel speed (VM), which is detected or derived by the second movement sensor (14), as a start variable of an integration cycle, and wherein
- a first monitoring module (18) compares the integrated travel speed (VS) with at least one predetermined limit speed (VG) and triggers the safety measure (27) if the predetermined limit speed (VG) is exceeded.

9. Safety equipment (12) according to claim 8, wherein a first comparison routine (21) of the safety equipment (12) compares the travel speed (VS), which is integrated by the integration routine (15), with the travel speed (VM) detected or derived by the second movement sensor (14) and starts a new integration cycle if the difference between the two travel speeds (VM, VS) exceeds the first difference limit value or if the duration of the current integration cycle exceeds the predetermined time period.

10. Safety equipment (12) according to claim 9, wherein the first comparison routine (21) of the safety equipment (12) compares the travel speed (VS), which is integrated by the first integration routine (15), with the travel speed (VM) detected or derived by the second movement sensor (14) and triggers the warning measure or safety measure (27) if

- the difference (dV) between the two travel speeds (VM, VS) exceeds the warning limit value or
- the time period of the difference between the two travel speeds (VM, VS) exceeds

the alarm value.

11. Safety equipment (12) according to any one of claims 8 to 10, wherein a second monitoring module (19) of the safety equipment (12) compares the travel speed (VM), which is detected by the second movement sensor (14) or derived by this, with at least one predetermined limit speed (VG2), which second monitoring module triggers the safety measure if the predetermined limit speed (VG2) is exceeded.

12. Safety equipment (12) according to any one of claims 7 to 11, wherein a third monitoring module (20) of the safety equipment (12) compares the acceleration (AS), which is detected by the first movement sensor (13), of the lift cage (2) with at least one predetermined limit acceleration (AG) and triggers a safety measure (27) if the predetermined limit acceleration (AG) is exceeded.

13. Safety equipment (12) according to any one of claims 7 to 12, wherein a comparison routine (24) of the safety equipment (12) for comparing the travel speed (VM), which is detected or derived by the second movement sensor (14), with the travel speed (VS), which is integrated by the integration routine (15), compares the travel speed (VM) detected or derived by the second movement sensor (14) with the travel speed (VS) integrated by the integration routine (15) and triggers a warning measure or safety measure (27)

- if the difference between the two travel speeds (VS, VM) exceeds the warning limit value or
- if a time plot of the difference between the two travel speeds (VS, VM) exceeds an alarm value.

14. Safety equipment (12) according to any one of claims 7 to 13 with a first processor unit (25) and a second processor unit (26), wherein the first processor unit (25) is connected with the first movement sensor (13) and the second processor unit (26) is connected with the second movement sensor (14) and wherein comparison routines, monitoring modules and further computing routines are apportioned to the two processor units (25, 26).

15. Safety equipment (12) according to claim 14, wherein the first processor unit (25) comprises at least the interface to the first movement sensor (13), the integration routine

(15), the first monitoring module (18) and if required the first comparison routine (21), the comparison routine (22) for comparing the acceleration (AS) with the second acceleration (AM) and the third monitoring module (20) and the second processor unit (26) comprises at least the interface to the second movement sensor (14), required computing routines (14.3, 17) for derivation of the signals detected by the second movement sensor (14) and if required the comparison routine (24) for comparing the travel speed detected or derived by the second sensor (14) with the travel speed (VS) integrated by the integration routine (15) and the second monitoring module (19).

16. Safety equipment (12) according to any one of claims 7 to 15, wherein the second movement sensor (14) is arranged in the region of a lift cage roller, preferably a support means deflecting roller (5) arranged on the cage (2), and is driven by this and the travel speed (VM) or the travel distance (SM) of the lift cage (2) is detected from a rotational movement of the lift cage roller or the support means deflecting roller (5).

17. Safety equipment (12) according to claim 16, wherein the safety equipment (12) comprises first safety equipment and second safety equipment, which first safety equipment is constructed in accordance with any one of claims 7 to 16 and arranged in the region of a first support means deflecting roller (5.1) of the lift cage (2) and which second safety equipment is constructed in accordance with any one of claims 7 to 16 and arranged in the region of a second support means deflecting roller (5.2) of the lift cage (2).