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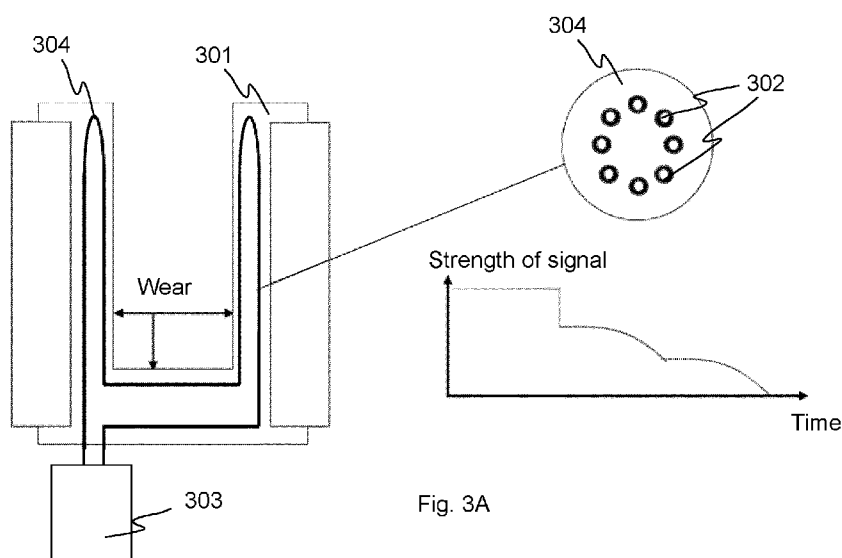


Fig. 3A

(57) Abstract: A method, an arrangement, and a system for monitoring components of a people conveyor system. The arrangement comprises light emitting means and light intensity measuring means (303), optical material connected to light emitting means and light intensity measuring means, the optical material arranged to guide light produced by the light emitting means through the optical material to the light intensity measuring means. At least part of the optical material is arranged inside and/or in connection with a monitored people conveyor component (111, 211). The light intensity measuring means and/or a control unit connected to the light intensity measuring means are configured to measure light intensity produced by the light emitting means guided through the optical material.



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AN ARRANGEMENT, A SYSTEM AND A METHOD FOR MONITORING COMPONENTS OF A PEOPLE CONVEYOR SYSTEM

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Field of the invention

The invention relates to an arrangement, a system and a method for monitoring components of a people conveyor system.

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Background

Conveyor systems, such as elevator systems, escalator systems, moving walkway systems, contain many wearing components. Beside of bearings and ropes, the wearing components are typically rotating and sliding parts in the system. For ensuring predictable lifetime and maintenance interval for wearing components the wear of the components has to be monitored.

In the current prior art systems wear for most important components is periodically checked on-site. This is done manually and requires competence and effort from maintenance person. The manual checking is sometimes producing incorrect interpretations which can lead to too early or too late component discharging and replacement. Unexpected component failures are very much unwanted because of reduction of conveyor system availability.

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For these reasons there is a need for a reliable and cost-effective component monitoring solution.

Summary

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An object of the invention is to present an arrangement, a system and a method for monitoring components of a people conveyor system.

The objectives of the invention are reached by an arrangement, a system and a method as defined by the respective independent claims.

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According to a first aspect, the invention relates to an arrangement for monitoring wear of a people conveyor component in a people conveyor system. The

arrangement comprises light emitting means and light intensity measuring means, optical material connected to light emitting means and light intensity measuring means, the optical material arranged to guide light produced by the light emitting means through the optical material to the light intensity measuring means. At least
5 part of the optical material is arranged inside and/or in connection with a monitored people conveyor component and the light intensity measuring means and/or a control unit connected to the light intensity measuring means are configured to measure light intensity produced by the light emitting means guided through the optical material.

10 In one embodiment of the invention the optical material is arranged to the monitored people conveyor component and/or to at least one separate component attachable to the monitored people conveyor component in such a way that when the monitored people conveyor component wears, the optical transmission quality
15 and/or optical transmission capability of the optical material decreases.

In one embodiment of the invention the optical material is arranged to the component and/or to at least one separate component attachable to the monitored people conveyor component in such a way that the optical material is wearing
20 essentially at the same time when the component is wearing, e.g. in connection with or on the area of wearing surface of the component.

In one embodiment of the invention the optical material comprises one optical fiber or multiple optical fibers, such as polymer optical fiber.

25 In one embodiment of the invention the optical material, such as optical fiber, is arranged inside elastomer material, which is arranged inside of the monitored component and/or to at least one separate component attachable to the monitored people conveyor component.

30 In one embodiment of the invention the light emitting means and/or the light intensity measuring means comprise at least one LED.

In one embodiment of the invention the light intensity measuring means comprises
35 at least one LED which is configured to be used in photoconductive mode.

In one embodiment of the invention the light emitting means and the light intensity measuring means comprise three LEDs, from which the first LED is configured to

emit light, the second LED is configured to measure light intensity and the third LED is configured to operate as a balancing resistor for the second LED.

5 In one embodiment of the invention monitored component of the people conveyor system is at least one of the following: a sliding guide shoe, such as guide shoe for an elevator car and/or a counterweight, brake pad and/or door slider.

10 In one embodiment of the invention the optical material is arranged to at least one separate component, wherein the monitored component, such as a guide shoe, has a cavity and/or an opening for each separate component to which the separate component can be arranged and/or fixed.

15 In one embodiment of the invention the monitored component is a guide shoe, and the arrangement comprises a housing with which the guide shoe is attachable to a wall or fixed structure of the people conveyor system and with which the separate component is attachable to the guide shoe.

20 In one embodiment of the invention the housing comprises two parts which are attachable together and/or a rubber isolator arranged between the parts, wherein the first part is arrangeable in connection with the guide shoe and the separate component, and the second part is arrangeable to a wall or fixed structure of the people conveyor system, and/or wherein the housing and the isolator comprise a through hole for the optical material travelling to the separate component.

25 In one embodiment of the invention the arrangement is configured to compare measured light intensity to a previously measured value and/or to a threshold light intensity value in order to determine wearing of the component, and/or the arrangement is configured to send measurement data and/or data relating to measurement data to an external device such as a computing device or server.

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According to a second aspect, the invention relates to a method for monitoring wear of people conveyor components in a people conveyor system. The method uses arrangement comprising light emitting means, light intensity measuring means and optical material connected to light emitting means and light intensity
35 measuring means for measuring wearing of a component. In the method the optical material guides light produced by the light emitting means through the optical material to the light intensity measuring means, wherein at least part of the optical material is arranged inside and/or in connection with a monitored people conveyor

component. In the method the light intensity measuring means and/or a control unit connected to the light intensity measuring means measure light intensity produced by the light emitting means guided through the optical material.

- 5 In one embodiment of the invention the method further comprises using at least one arrangement according to the invention for the monitoring wear of the component.

- 10 In one embodiment of the invention the method further comprises comparing the measured light intensity to a previously measured value and/or to a threshold light intensity value in order to determine wearing of the component, and/or sending the measurement data and/or data relating to measurement data to an external device such as a computing device or server.

- 15 According to a third aspect, the invention relates to a people conveyor component. The people conveyor component comprises optical material arranged inside and/or in connection with the people conveyor component. The optical material is arranged to the people conveyor component and/or to at least one separate component attachable to the people conveyor component in such a way that when
20 the people conveyor component wears, the optical transmission quality and/or optical transmission capability of the optical material decreases.

- In one embodiment of the invention the people conveyor component comprises a guide shoe, a housing with which the guide shoe is attachable to a wall or fixed
25 structure of the people conveyor system and/or with which the separate component is attachable to the guide shoe.

- In one embodiment of the invention the housing comprises two parts which are attachable together and/or a rubber isolator arranged between the parts, wherein
30 the first part is arrangeable in connection with the guide shoe and the separate component, and the second part is arrangeable to a wall or other structure, and/or wherein the housing and the isolator comprise a through hole for the optical material travelling to the separate component.

- 35 According to a fourth aspect, the invention relates to a people conveyor system, which comprises at least one arrangement or component according to the invention for the monitoring wear of a people conveyor component.

In one embodiment of the invention the people conveyor system is an elevator system comprising at least an elevator car, a motor configured to move the elevator car and an elevator controller configured to control the elevator and/or the motor, and wherein the monitored component is an elevator system component.

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The elevator system may refer herein to a conventional elevator in which an elevator car is moved in a vertical direction, that is up and down, by a hoisting rope in connection with a hoisting motor. However, the elevator system may alternatively refer to an elevator utilizing an electric linear motor, that is to a ropeless or rope-free elevator, for moving the elevator car in vertical direction or in any direction.

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In one embodiment of the invention the people conveyor system is an escalator system comprising at least steps, step chain, a motor configured to move the step chain and an escalator controller configured to control the escalator and/or the motor, and wherein the monitored component is an escalator system component, e.g. a brake pad.

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In one embodiment of the invention the people conveyor system is a moving walkway system comprising at least pallets, pallet chain, a motor configured to move the pallet chain and a moving walkway controller configured to control the moving walkway and/or the motor, and wherein the monitored component is a moving walkway system component, e.g. a brake pad.

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With the solution of the invention wear of people conveyor components can be automatically and reliably monitored without expensive monitoring equipment. Monitoring can be done during normal people conveyor operation such that it is not necessary to take people conveyor out of use for the duration of measurement or monitoring. With the wear monitoring according the invention also automatic life-time prediction and clear maintenance intervals and discharging limits can be created. The collected component wear information may be used for preventive maintenance of the conveyor systems. In some embodiments, the method may comprise sending information about the condition of the monitored component to a remote maintenance server.

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The solution of the invention can be used e.g. for sliding guide shoe wear monitoring, hoisting machinery brake pad wear monitoring and door slider wear monitoring.

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Various other advantages will become clear to a skilled person based on the following detailed description.

5 The expression "a number of" may herein refer to any positive integer starting from one (1).

The expression "a plurality of" may refer to any positive integer starting from two (2), respectively.

10 The terms "first", "second" and "third" are herein used to distinguish one element from other element, and not to specially prioritize or order them, if not otherwise explicitly stated.

15 The exemplary embodiments of the present invention presented herein are not to be interpreted to pose limitations to the applicability of the appended claims. The verb "to comprise" is used herein as an open limitation that does not exclude the existence of also unrecited features. The features recited in dependent claims are mutually freely combinable unless otherwise explicitly stated.

20 The novel features which are considered as characteristic of the present invention are set forth in particular in the appended claims. The present invention itself, however, both as to its construction and its method of operation, together with additional objectives and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the
25 accompanying drawings.

Brief description of the Figures

30 Some embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings.

Fig. 1 illustrates an elevator according to one example embodiment of the invention,

35 Fig. 2 illustrates an escalator according to one embodiment of the invention,

Fig. 3A-B illustrate example embodiments of the invention relating to arranging of the optical material to the monitored component,

Fig. 4A-F illustrate schematically an example embodiment of a monitored component, and

- 5 Fig. 5 presents a flow diagram of a method according to an embodiment of the invention.

Detailed description of some embodiments

- 10 The specific examples provided in the description given below should not be construed as limiting the scope and/or the applicability of the appended claims. Lists and groups of examples provided in the description given below are not exhaustive unless otherwise explicitly stated.

- 15 Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

- 20 With the solution of the invention, it is possible to monitor the condition of the people conveyor components. Monitoring can be done during normal people conveyor operation such that it is not necessary to take people conveyor out of use for the duration of measurement or monitoring.

- Figure 1 schematically illustrates an embodiment according to the present invention in which the solution of the invention is used in the connection with a people conveyor system. In this case the people conveyor system is an elevator system. The elevator system comprises an elevator shaft 101 in which an elevator car 102 moves to serve different floors. In Figure 1 the elevator car 102 can stop in a first floor 103, second floor 104, third floor 105 and fourth floor 106. The floors may be any floor in a building and not necessarily the first and second floor of the building. The first floor 103 may be, for example, a garage and the second floor 104 the ground level. A landing door 107 can be arranged in each floor in front of the elevator car 102. In Figure 1 the elevator comprises a motor 108 configured to move the elevator car via the hoisting rope, wherein the motor 108 is controlled by an elevator control unit 110. This arrangement is, however, only an example.

- 35 The monitored component 111 can be arranged to the elevator car or in connection with the elevator car. The monitored component can be e.g. a sliding guide shoe, a hoisting machinery brake pad and/or a door slider. The arrangement used to

monitor the condition of the people conveyor component can be communicatively connected to elevator control unit 110 and/or to a remote system 112. The elevator control unit 110 can be communicatively connected to a remote system and/or can control the operation of the arrangement.

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The arrangement can process at least part of the data itself and/or the control unit 110 can process at least a part of the data. This conveyor component condition monitoring related data can be sent forward to a remote system 112 and/or a server, such as a cloud server. The service can also take care of at least part of the data processing.

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Figure 2 schematically illustrates an embodiment according to the present invention in which the solution of the invention is also used in the connection with a people conveyor system. In this case the people conveyor system is an escalator 15 200. The escalator may comprise a step-chain coupled to a motor 206 via a transmission 202 comprising at least a chain or belt or similar. The motor 206 may generate a rotational force via the transmission causing the step-chain to move in an intended travelling direction. A brake may be arranged to the conveyor system so that when de-energized it is configured to meet the rotating axis of the 20 transmission and, in that manner, to brake movement of the step chain or keep the step chain standstill when the escalator system is idle. When energized, the brake opens, allowing movement of step-chain. The transmission may comprise, in the context of escalator system, a gearbox with the mentioned entities. Furthermore, the escalator system may comprise an escalator control unit 210 which may e.g. 25 be configured to control the movement of step-chain through a control of a power supply to the motor 202 and to the escalator brake. In one embodiment of the invention the conveyor system can comprise a processing unit 204. In some embodiments a second motor 207 with a second transmission 203 may be provided, for example, at the opposite end of the step-chain. Then a second 30 processing unit 205 may be mounted to the in connection with the second motor. The monitored component 211 is arranged in connection with the escalator. The arrangement for monitoring the condition of the components can be communicatively connected to the conveyor control unit.

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35 The light emitting means and light intensity measuring means used in the solution of the invention can be arranged in connection with the wearing component or at a certain distance away from the wearing component in which case optical material is arranged to guide light produced by the light emitting means through the optical

material to the light intensity measuring means. The light emitting means and light intensity measuring means can be arranged to a single unit or to separate units. At least part of the optical material is arranged inside and/or in connection with a monitored people conveyor component and the light intensity measuring means and/or a control unit connected to the light intensity measuring means measure light intensity produced by the light emitting means guided through the optical material. In one embodiment of the invention the monitored component of the people conveyor system is at least one of the following: a sliding guide shoe, such as guide shoe for an elevator car and/or a counterweight, brake pad and/or door slider.

In one embodiment of the invention the optical material is arranged to the monitored people conveyor component and/or to at least one separate component attachable to the monitored people conveyor component in such a way that when the monitored people conveyor component wears, the optical transmission quality and/or optical transmission capability of the optical material decreases. The optical material is arranged to the component and/or to at least one separate component attachable to the monitored people conveyor component in such a way that the optical material is wearing essentially at the same time when the component is wearing, e.g. in connection with or on the area of wearing surface of the component.

The arrangement or a separate control unit can compare measured light intensity to a previously measured value and/or to a threshold light intensity value in order to determine wearing of the component. The arrangement or a separate control unit can be configured to send measurement data and/or data relating to measurement data to an external device such as a computing device or server.

In one embodiment of the invention the optical material comprises one optical fiber or multiple optical fibers, such as polymer optical fiber. The optical material, such as optical fiber, can be arranged inside elastomer material, which is arranged inside of the monitored component, e.g. directly inside of wearing material piece.

These elastomer material or single fibers can be positioned inside the monitored component, such as a guide shoe or brake pad material. When component material wears out, then optical fibers are abrasively worn and cut one per one. This can be detected by reading light intensity drop, i.e. light intensity is a function of how many of fibers are still in the wearing component.

Fig. 3A-B illustrate example embodiments of the invention relating to the arranging of the optical material to the monitored component. In figure 3A optical fibers are placed and circulated inside of a guiding shoe 301, near or at the wearing surfaces of the guiding shoe. The arrangement of the fibers 302 can be done e.g. so that
5 important wear threshold values or linear wear can be precisely detected by the light emitting means and light intensity measuring means 303 to which the optical fibers are connected. When the part wears also the fibers 302 wear off, e.g. one by one, and thus the light transmitted through the optical fibers is reduced as the
10 guiding shoe wears.

In the embodiment of Figure 3A cross-section of elastomers 304 to which several optical fibers 302 are embedded is round. In figure 3A it is also illustrated how wear of fibers reduce optical volume which leads to light intensity reduction, i.e. the more
15 fibers wear out the lower is light intensity.

It is possible to produce other wanted shapes, e.g. rectangular shapes as is illustrated in the embodiment of Figure 3B. Rectangular shape can more beneficial for example for guide shoe applications which have deeper wear surface. In the
20 embodiment of Figure 3B optical fibers are arranged to an essentially rectangular elastomer 305 so that the fibers 306 are arranged in one layer. This enables thicker monitoring depth. Number of layers can preferably vary if higher resolution is wanted. In the solution of Figure 3B, the optical fibers wear off, e.g. one by one, when the component and the elastomer wears. The embodiment of Fig. 3B can be
25 used in the solution of the Figure 3A instead of the elastomer having a round shaped cross section.

Manufacturing technology of elastomer component, such as a guiding shoe is typically some kind of molding and/or machining methods. For example, injection
30 or pressure molding without any finishing machining can be found advantageous. Optical fibers can be placed inside of mold for example by using jigs. Maximum temperature for optical fibers and elastomers is typically 200 degrees Celsius. Thus, manufacturing temperature shall be controlled for avoiding unwanted melting of fibers or surrounding elastomer. Materials can be chosen such way that
35 adhesion is gained highest possible.

Shape of the elastomer part where optical fibers are inside can be constructed according to the shoe dimensions and manufacturability. So, it can be something

else than round or rectangular. Number of single fibers can naturally vary depending on the target wear depth and required resolution. Also using only single fiber for discharging limit indicator is possible.

5 In one embodiment of the invention the optical material is arranged to at least one separate component, wherein the monitored component, such as a guide shoe, has a cavity and/or an opening for each separate component to which the separate component can be arranged and/or fixed. In one embodiment of the invention, one separate component can be arranged to the people conveyor component, such as
10 a guide shoe, e.g. in the middle of the people conveyor component. In one embodiment of the invention, two separate components can be arranged to the people conveyor component, such as a guide shoe, e.g. to the top and bottom ends of the people conveyor component. Also, further separate components can be arranged to the monitored people conveyor component, if needed.

15 Figures 4A-G illustrate one example of a solution with a separate component which comprises the optical material. The component in this example embodiment is a guide shoe.

20 Figures 4A and 4B present the sliding guide shoe 401 from both sides of the structure. The sliding guide shoe 401 has a cavity 402 and an opening 403 to which the separate component 404 comprising the optical material can slide and be attached. Sliding guide shoe can be made e.g. from abrasive-resistant elastomer, for example from ultra-high molecular weight polyethylene, Nylube, PEEK, PA6 or
25 PA66, and e.g. by compression or die casting.

Figures 4C-E illustrate the above-mentioned separate component 404 from different side views. The optical material travels through the separate component and the optical material is then connected to the light emitting and light intensity
30 measuring means (not presented in figure). The separate component can be manufactured from an elastomer that wears when it is used, and it can comprise e.g. one of the following materials: Polymix PUR 130, Araldite Epoxy 2011, PERMABOND TA430 Acrylic, Araldite Epoxy 2011. The optical material can be arranged to the separate component as described above. In one embodiment of
35 the invention the optical material comprises 4 – 8 optical fibers which are arranged inside the separate component in such a way that when the separate component wears, the optical quality of the optical material decreases. This can be

implemented e.g. by arranging the optical fibers at different distances from the wearing surfaces.

Figure 4F illustrates how the separate component can be attached to the other components of the system to form a guide shoe arrangement 400, e.g. a sliding guide shoe arrangement. In this example the guiding shoe 401 can be arranged with the separate component 404 comprising the optical material to a housing comprising two parts 405, 406 and rubber isolator 407. The two parts 405, 406 of the housing comprise means for attaching these parts 405, 406 together. The two parts 405, 406 of the housing can be made of material that has enough structural strength, e.g. steel or aluminum. The first part of the housing 405 is arrangeable in connection with the guide shoe 401 and the separate component 404 e.g. so that the separate component is fixed and kept in connection with the guide shoe 401 by the first part 405 of the housing. The second part 406 of the housing is arrangeable to a wall or other structure. The rubber isolator 407, if used, can be arranged between the parts 405, 406 of the housing. The isolator doesn't have to comprise rubber, but it can also comprise other material which can dampen the vibration or sound. The housing and the isolator can comprise a through hole 408 for the optical material travelling to the separate component. With the housing the guide shoe is attachable to a desired position in the elevator system.

Fig. 4G illustrates four sliding guide shoe arrangements 400 at the corners of elevator car sling or counterweight frame. In each of sliding guide shoe have three surfaces which are carrying car tilt forces. Tilt forces are creating lateral force components in two directions. Wear of these surfaces can be monitored with the embodiment presented in Figures 4A-F.

Measuring of light intensity in the solution of the invention can be based on known technology. In order to keep the cost down, both the light emission and light detection can in one embodiment of the invention be based on LEDs or other known light source in the market.

In one embodiment of the invention the light emitting means and/or the light intensity measuring means comprise at least one LED. In one embodiment of the invention the light intensity measuring means can use the at least one LED to detect light. In one embodiment of the invention the light intensity measuring means can use the at least one LED in photoconductive mode for detecting light.

When placing the LED in photoconductive mode, one of the biggest issues is that the resistance of the LED is very high. It can be difficult to find a resistor that matches the LED resistance and compensate for the fact that the LED resistance is temperature sensitive. In one embodiment of the invention the light emitting means and/or the light intensity measuring means comprise three LEDs, from which the first LED is configured to emit light, the second LED is configured to measure light intensity and the third LED is configured to operate as a balancing resistor for the second LED. The second LED can be arranged so that it will not receive any light, and so the resistance of the second LED will remain constant with regards to light levels. In one embodiment of the invention, an additional resistor can be connected in series with the first LED.

In one embodiment of the invention the light emitting means can produce constant light and/or can produce pulsing light. The capability of pulsing the emitting LED gives capability of subtracting background noise or light which can be implemented e.g. with signal processing.

It is important for the solution of the invention that the detection method is stable in long term. If there is any drift in voltages provided for the light sources, in one embodiment of the invention a background measurement can be used to eliminate this drift. If there is a change in temperature, then in one example embodiment with three LEDs, temperature change can be compensated by the third LED operating as a balancing resistor for the second LED.

Figure 5 shows a flow diagram of a method according to an embodiment of the present invention. In the example method of Figure 5 arrangement comprising light emitting means, light intensity measuring means and optical material connected to light emitting means and light intensity measuring means are used for measuring wearing of a component. In the method the optical material guides light produced by the light emitting means through the optical material to the light intensity measuring means, wherein at least part of the optical material is arranged inside and/or in connection with a monitored people conveyor component. The light intensity measuring means and/or a control unit connected to the light intensity measuring means measure light intensity produced by the light emitting means guided through the optical material.

The arrangement and/or a control unit of the system can send data relating to measurements to a remote system or service. At least one communication channel

can be arranged between the arrangement and/or the control unit and a remote system. In the solution of the invention the arrangement and/or the control unit provides data related to condition measurements via the at least one communication channel to the remote system. In one embodiment of the invention the remote system can request data relating to condition measurements from the arrangement and/or the control unit. In one embodiment of the invention the arrangement and/or control unit can provide, e.g. continuously and/or periodically, data relating to condition measurements from the arrangement and/or the control unit to the remote system also without the remote system requesting the data.

The arrangement and/or a control unit of the system may be a separate processing unit, or it may be a functionality added to some existing conveyor component, such as an elevator control unit and/or elevator group controller. A arrangement or controller of a conveyor system in which the solution of the invention can be used may comprise at least one processor connected to at least one memory. The at least one memory may comprise at least one computer program which, when executed by the processor or processors, causes the controller to perform the programmed functionality. In another embodiment, the at least one memory may be an internal memory of the at least one processor. The controller may also comprise an input/output interface. Via the input/output interface, the control apparatus may be connected to the required devices or units. The controller may be a control entity configured to implement only the above disclosed operating features, or it may be part of a larger elevator control entity, for example, a conveyor controller, such as an elevator controller, an escalator controller or a moving walkway controller.

As stated above, the components or other parts of the exemplary embodiments can include computer readable medium or memories for holding instructions programmed according to the teachings of the present embodiments and for holding data structures, tables, records, and/or other data described herein. Computer readable medium can include any suitable medium that participates in providing instructions to a processor for execution. Common forms of computer-readable media can include, for example, a floppy disk, a flexible disk, hard disk, magnetic tape, any other suitable magnetic medium, a CD-ROM, CD±R, CD±RW, DVD, DVD-RAM, DVD±RW, DVD±R, HD DVD, HD DVD-R, HD DVD-RW, HD DVD- RAM, Blu-ray Disc, any other suitable optical medium, a RAM, a PROM, an EPROM, a FLASH-EPROM, any other suitable memory chip or cartridge or any other suitable medium from which a computer can read.

The embodiments of the invention described herein before in association with the figures presented and the summary of the invention may be used in any combination with each other. At least two of the embodiments may be combined
5 together to form a further embodiment of the invention.

The specific examples provided in the description given above should not be construed as limiting the applicability and/or the interpretation of the appended claims. Lists and groups of examples provided in the description given above are
10 not exhaustive unless otherwise explicitly stated.

Claims

1. An arrangement for monitoring wear of people conveyor components in a people conveyor system, **characterized** in that the arrangement comprises:
- 5 light emitting means and light intensity measuring means (303),
optical material connected to light emitting means and light intensity measuring means (303), the optical material arranged to guide light produced by the light emitting means through the optical material to the light intensity measuring means, wherein at least part of the optical material is arranged inside and/or in
- 10 connection with a monitored people conveyor component (111, 211),
wherein the light intensity measuring means and/or a control unit connected to the light intensity measuring means are configured to measure light intensity produced by the light emitting means guided through the optical material.
- 15 2. An arrangement according to claim 1, wherein the optical material is arranged to the monitored people conveyor component (111, 211) and/or to at least one separate component (404) attachable to the monitored people conveyor component in such a way that when the monitored people conveyor component (111, 211) wears, the optical transmission quality and/or optical transmission
- 20 capability of the optical material decreases.
3. An arrangement according to claim 1 or 2, wherein the optical material is arranged to the people conveyor component (111, 211) and/or to at least one separate component (404) attachable to the monitored people conveyor
- 25 component in such a way that the optical material is wearing essentially at the same time when the people conveyor component (111, 211) is wearing, e.g. in connection with or on the area of wearing surface of the people conveyor component.
- 30 4. An arrangement according to any preceding claim, wherein the optical material comprises one optical fiber or multiple optical fibers (302, 306), such as polymer optical fiber.
- 35 5. An arrangement according to any preceding claim, wherein the optical material, such as optical fiber (302 306), is arranged inside elastomer material (304, 305), which is arranged inside of the monitored component and/or to at least one separate component attachable to the monitored people conveyor component.

6. An arrangement according to any preceding claim, wherein the light emitting means and/or the light intensity measuring means (303) comprise at least one LED.

5 7. An arrangement according to any preceding claim, wherein the light intensity measuring means comprises at least one LED which is configured to be used in photoconductive mode.

10 8. An arrangement according to any preceding claim, wherein the light emitting means and the light intensity measuring means (303) comprise three LEDs, from which the first LED is configured to emit light, the second LED is configured to measure light intensity and the third LED is configured to operate as a balancing resistor for the second LED.

15 9. An arrangement according to any preceding claim, wherein the arrangement is configured to compare measured light intensity to a previously measured value and/or to a threshold light intensity value in order to determine wearing of the people conveyor component (111, 211), and/or
the arrangement is configured to send measurement data and/or data
20 relating to measurement data to an external device such as a computing device or server.

10 10. An arrangement according to any preceding claim, wherein the monitored component of the people conveyor system is at least one of the
25 following: a sliding guide shoe (301, 401), such as guide shoe for an elevator car and/or a counterweight, brake pad and/or door slider.

30 11. An arrangement according to any preceding claim, wherein the optical material is arranged to at least one separate component (404), wherein the monitored component, such as a guide shoe (401), has a cavity (402) and/or an opening (403) for each separate component to which the separate component can be arranged and/or fixed.

35 12. An arrangement according to claim 11, wherein the monitored component is a guide shoe (401), and the arrangement comprises a housing with which the guide shoe (401) is attachable to a wall or fixed structure of the people conveyor system and with which the separate component (404) is attachable to the guide shoe (401).

13. An arrangement according to claim 12, wherein the housing comprises two parts (405, 406) which are attachable together and/or a rubber isolator (407) arranged between the parts, wherein the first part (405) is arrangeable in connection with the guide shoe (401) and the separate component (404), and the second part (406) is arrangeable to a wall or fixed structure of the people conveyor system, and/or wherein the housing and the isolator comprise a through hole (408) for the optical material travelling to the separate component (404).

14. A method for monitoring wear of people conveyor components in a people conveyor system, **characterized** in that, the method uses arrangement comprising light emitting means, light intensity measuring means (303) and optical material connected to light emitting means and light intensity measuring means (303) for measuring wearing of a component,

wherein in the method the optical material guides light produced by the light emitting means through the optical material to the light intensity measuring means, wherein at least part of the optical material is arranged inside and/or in connection with a monitored people conveyor component (111, 211),

wherein the light intensity measuring means and/or a control unit connected to the light intensity measuring means measure light intensity produced by the light emitting means guided through the optical material.

15. A method according to claim 12, wherein the method further comprises using at least one arrangement of claims 2 – 11 for the monitoring wear of the component.

16. A method according to claim 12 or 13, wherein the method further comprises comparing the measured light intensity to a previously measured value and/or to a threshold light intensity value in order to determine wearing of the people conveyor component (111, 211), and/or

sending the measurement data and/or data relating to measurement data to an external device such as a computing device or server.

17. A people conveyor component **characterized** in that the people conveyor component comprises optical material arranged inside and/or in connection with the people conveyor component, wherein the optical material is arranged to the people conveyor component (111, 211) and/or to at least one separate component (404) attachable to the people conveyor component in such

a way that when the people conveyor component (111, 211) wears, the optical transmission quality and/or optical transmission capability of the optical material decreases.

5 18. A people conveyor component according to claim 17, wherein the people conveyor component comprises a guide shoe (401), a housing with which the guide shoe (401) is attachable to a wall or fixed structure of the people conveyor system and/or with which the separate component (404) is attachable to the guide shoe (401).

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 19. A people conveyor component according to claim 18, wherein the housing comprises two parts (405, 406) which are attachable together and/or a rubber isolator (407) arranged between the parts, wherein the first part (405) is arrangeable in connection with the guide shoe and the separate component (404),
15 and the second part (406) is arrangeable to a wall or other structure, and/or wherein the housing and the isolator comprise a through hole (408) for the optical material travelling to the separate component (404).

 20. A people conveyor system, **characterized** in that the people conveyor
20 system comprises the arrangement according to any claim 1 – 13 or the component according to claims 17 – 19.

 21. A people conveyor system according to claim 15, wherein
 the people conveyor system is an elevator system (200) comprising at least
25 an elevator car (202), a motor (208) configured to move the elevator car and an elevator controller (210) configured to control the elevator and/or the motor, or
 the people conveyor system is an escalator system (400) comprising at least steps, step chain, a motor (406) configured to move the step chain and an escalator controller (410) configured to control the escalator and/or the motor, or
30 the people conveyor system is a moving walkway system comprising at least pallets, pallet chain, a motor configured to move the pallet chain and a moving walkway controller configured to control the moving walkway and/or the motor.

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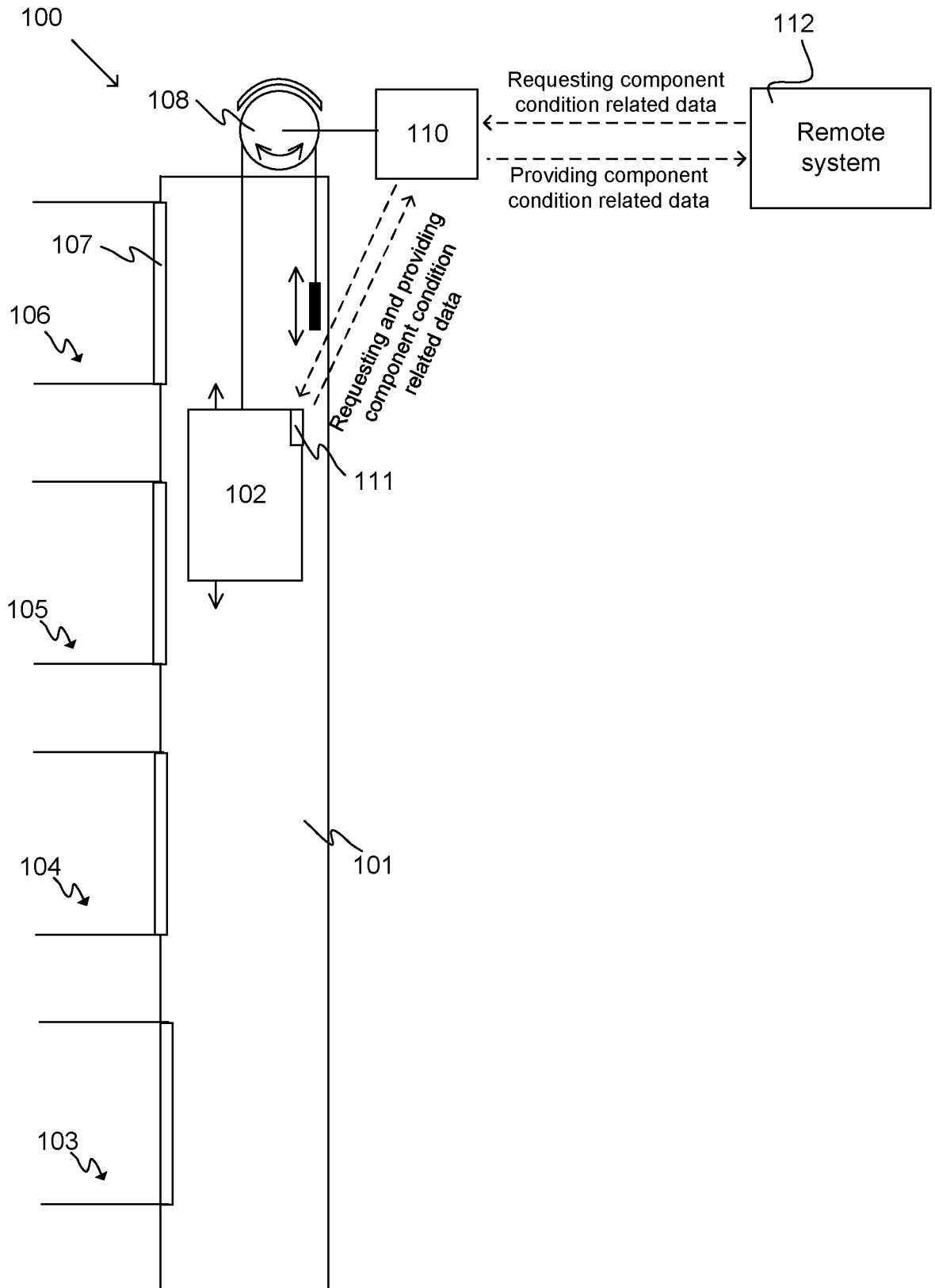


Fig. 1

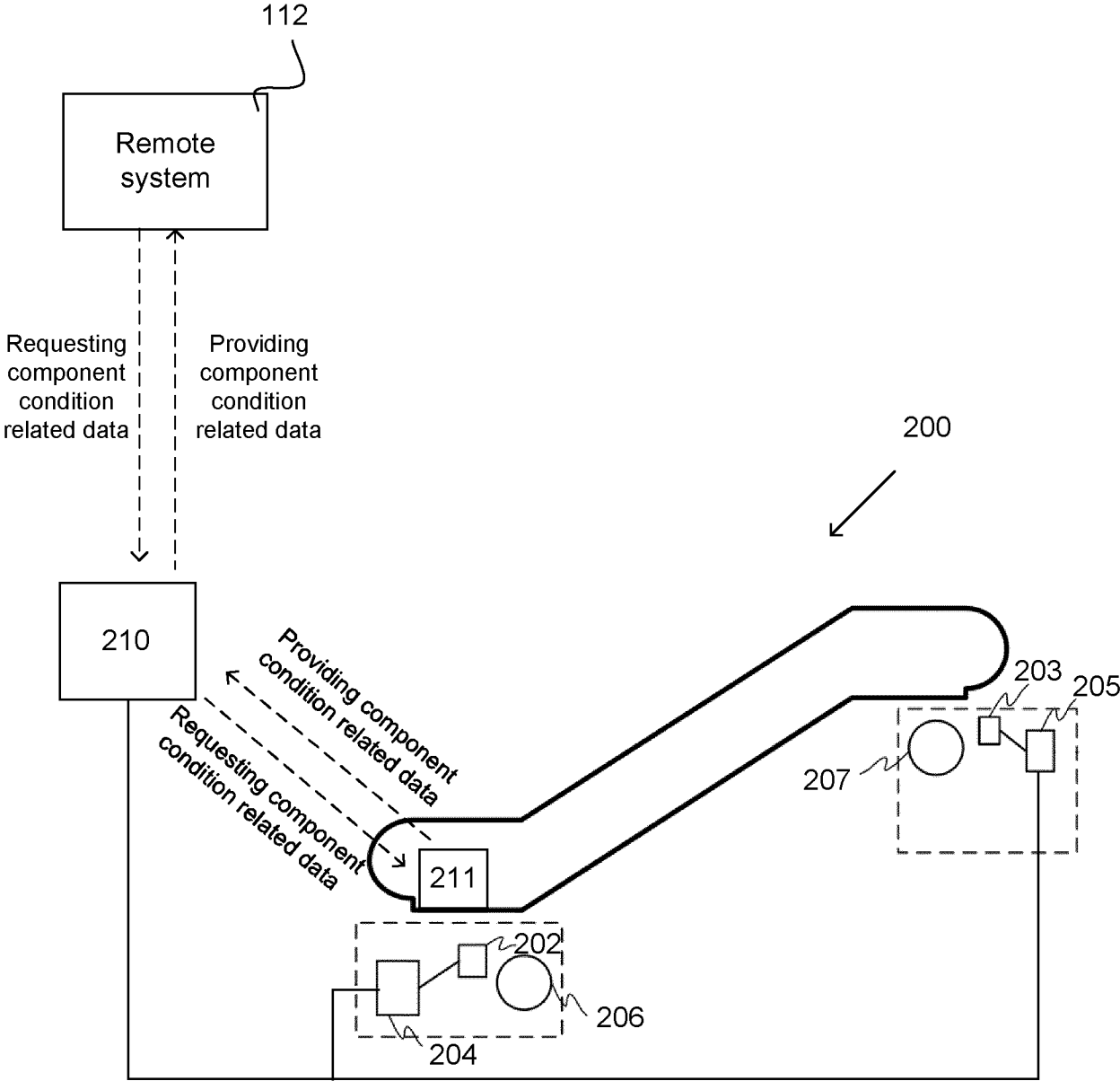


Fig. 2

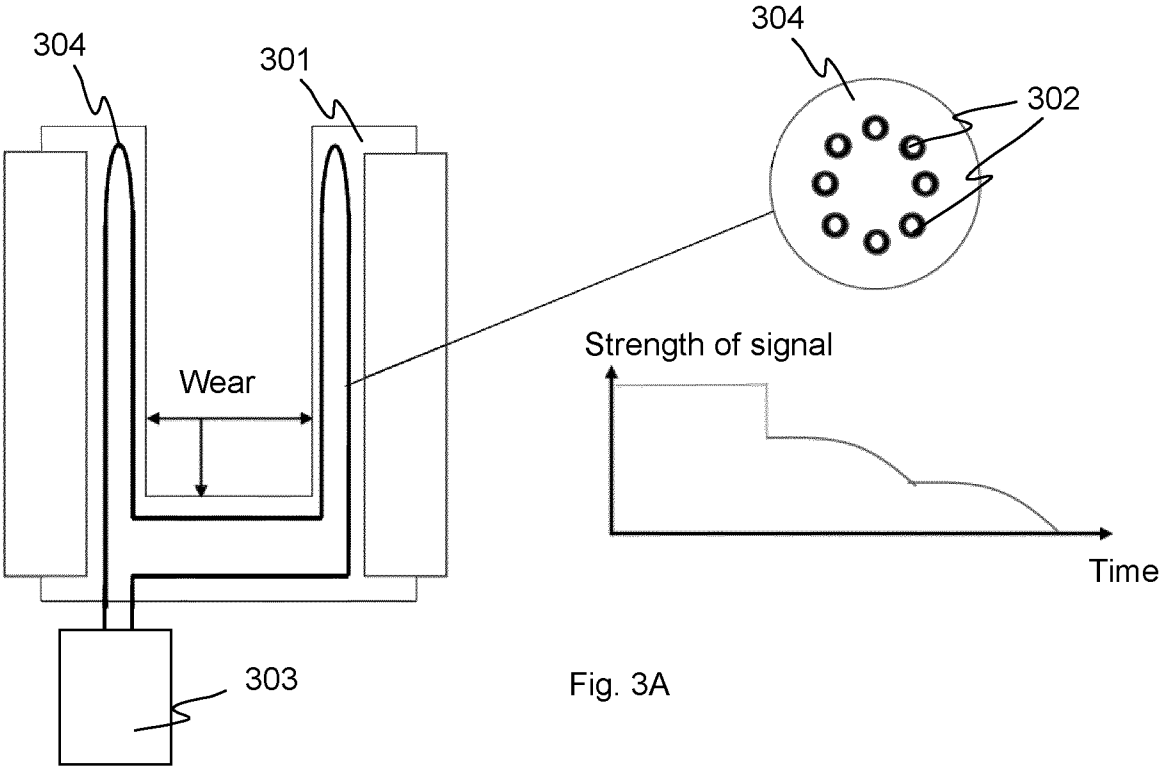


Fig. 3A

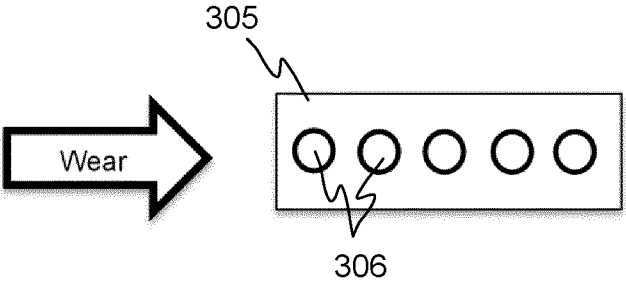


Fig. 3B

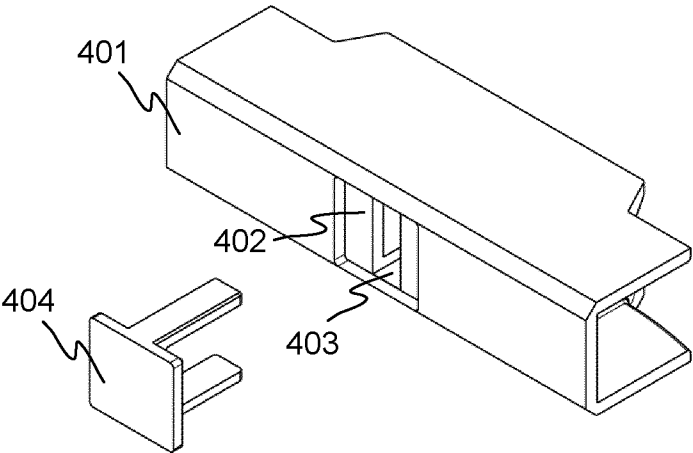


Fig. 4A

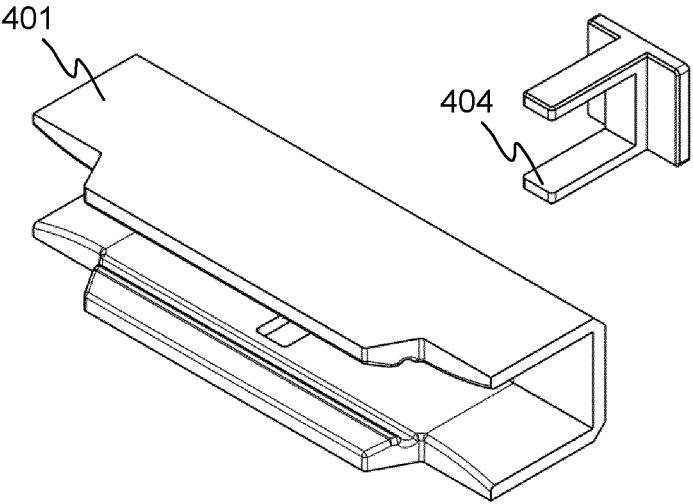


Fig. 4B

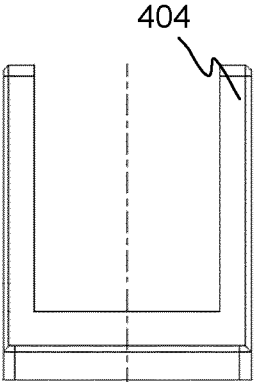


Fig. 4C

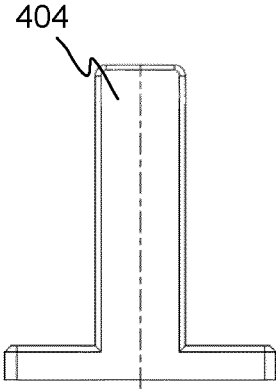


Fig. 4D

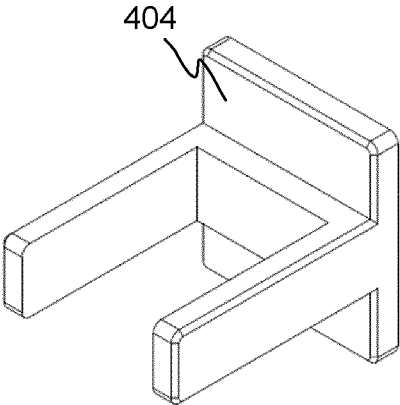


Fig. 4E

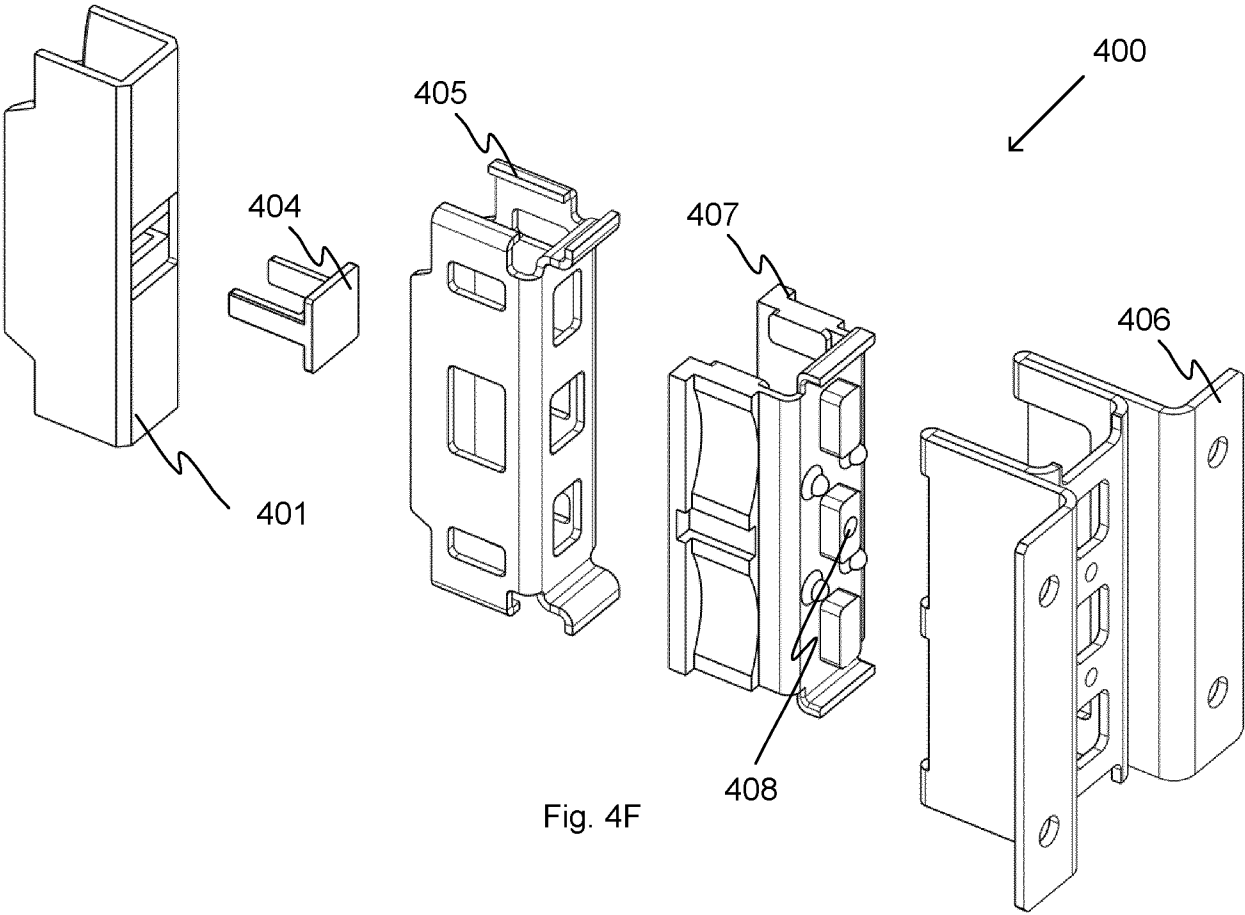


Fig. 4F

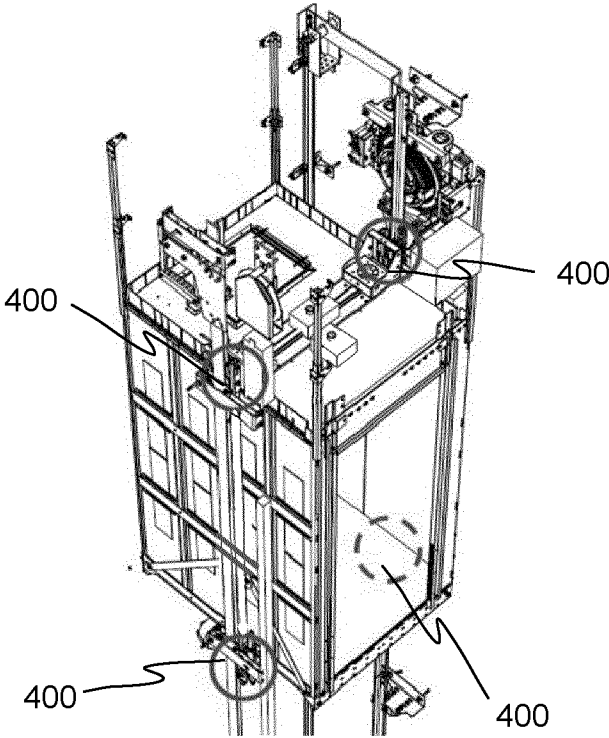


Fig. 4G

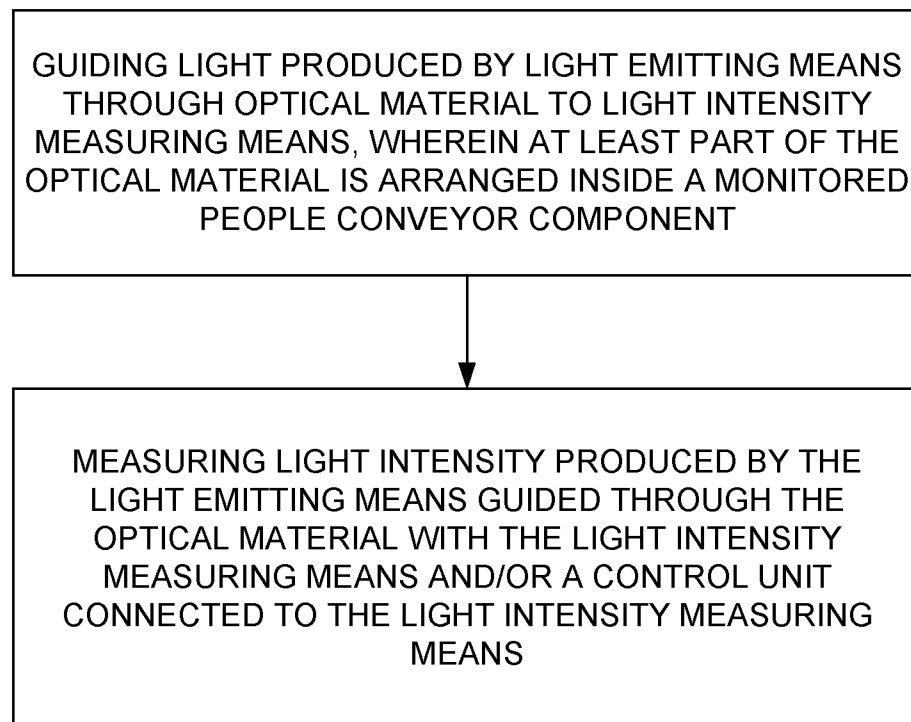


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2021/057569

A. CLASSIFICATION OF SUBJECT MATTER

INV. B66B5/00 B66B25/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	pages 1-8; figures 1-4	5,10-13, 18,19
X	----- US 2014/305744 A1 (KERE PETRI [FI] ET AL) 16 October 2014 (2014-10-16)	1-9, 14-17, 20,21
A	pages 1-7, paragraph 0109-0112; figures 1-4	10-13, 18,19
X	----- US 6 147 620 A (REMMERS TIMOTHY M [US] ET AL) 14 November 2000 (2000-11-14)	1,4,6,7, 14-16, 20,21
A	pages 1-2, columns 2-3; figures 1-2	2,3,5, 8-13, 17-19
	----- -/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search

10 November 2021

Date of mailing of the international search report

18/11/2021

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2021/057569

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