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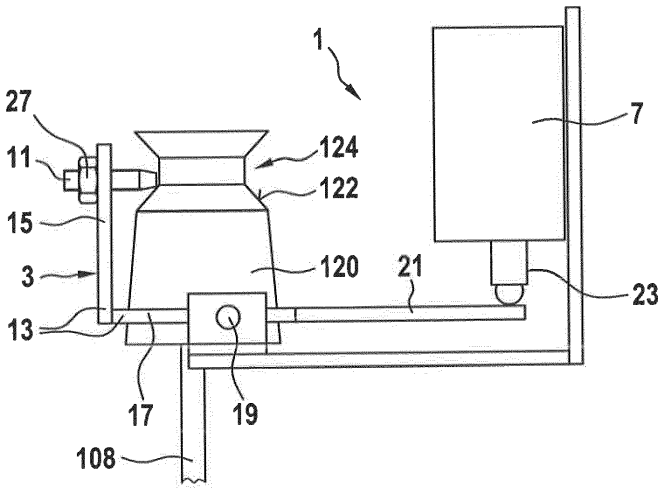
(54) MONITORING DEVICE FOR DETECTING SLACK IN AN ARRANGEMENT COMPRISING A MULTIPLICITY OF FLEXIBLE SUSPENSION AND TRACTION MEDIA (STM) OF AN ELEVATOR

(57) A monitoring device (1) for detecting slack in an arrangement comprising a multiplicity of flexible suspension and traction media STM (108) of an elevator arrangement is presented. The monitoring device (1) comprises an elongate engagement and actuation part (3) and a sensor (7). The elongate engagement and actuation part (3) comprises at least two engagement protrusions extending in a protrusion direction. The elongate engagement and actuation part (3) is arranged and adapted such that, when the elongate engagement and actuation part (3) is arranged adjacent to each of the multiplicity of flexible STMs (108), the at least two engagement protrusions each mechanically interact with one of the flexible STMs (108) such that, when a slack occurs in one of the flexible STMs (108), a resulting motion of the respective STMs (108) is transferred mechanically to the elongate engagement and actuation part (3). The sensor (7) is arranged and adapted such as to detect the motion of the elongate engagement and actuation part (3). The elongate engagement and actuation part (3) comprises a plurality of screws (11) forming the engagement protrusions. Due to such engagement protrusions being formed by screws (11), an engagement of each of the protrusions into e.g. a respective recess (124) of a holder (120) connected to one of the STMs (108) may be precisely positioned for example by tightening the associated screw (11). Thereby, slack detection of the STMs may be improved.

Fig. 4



EP 3 121 140 A1

Description

[0001] The present invention relates to a monitoring device for detecting slack in an arrangement comprising a multiplicity of flexible suspension and traction media of an elevator, particularly of a traction sheave elevator. Furthermore, the invention relates to an elevator arrangement comprising such monitoring device and to a method for installing such monitoring device.

[0002] In elevators, an elevator cabin and/or a counterweight are typically supported by at least one flexible suspension and traction medium, hereinafter referred to as "STM". Such STM may be for example a cable, rope or belt. Such STM may carry heavy loads of e.g. several hundreds of kilograms when loaded in a longitudinal tensioning direction. However, the STM is typically flexible, i.e. may be deflected, bent or curved in a direction transverse to its longitudinal direction. Accordingly, lacking any load in tensioning direction, the STM may slack.

[0003] Particularly, in modern elevator arrangements of the traction sheave type, the STM is generally driven by a traction sheave which itself is driven for example by a motor. Therein, a friction between the traction sheave and the STM may be very high. Due to such high friction, situations may occur in which for example the cabin or the counterweight may not be displaced due to being for example stuck in a fixed position within an elevator shaft and then, as a result of a lacking motion of this elevator component, portions of the STM may become loose, i.e. may slack. Such slacking of the STM may result in undesirable or even dangerous situations. Accordingly, any slack of an STM should be detected in a reliable manner.

[0004] For example, WO 2007/144456 describes an arrangement for detecting a slack rope in a traction sheave elevator. EP 1 953 108 B1 describes an elevator in which load variations on an STM may be detected with a sensor. WO 2011/131574 A1 describes monitoring the operation state of suspensions in an elevator system wherein a slack support member switch is comprised in an elevator arrangement.

[0005] There may be a need for a monitoring device for detecting slack in an arrangement comprising a multiplicity of flexible STMs of an elevator arrangement which monitoring device, inter alia, may be easily installed and operate in a reliable manner. Furthermore, there may be a need for an elevator arrangement comprising such monitoring device and for a method of installing such monitoring device in an easy and reliable manner.

[0006] Such needs may be met with the subject-matter of the independent claims. Advantageous embodiments are defined in the dependent claims.

[0007] According to an aspect of the present invention, a monitoring device for detecting slack in an arrangement comprising a multiplicity of flexible suspension and traction media of an elevator arrangement is proposed, the monitoring device comprising an elongate engagement and actuation part and further comprising a sensor. Therein, the elongate engagement and actuation part comprises at least two engagement protrusions extending in a protrusion direction. The elongate engagement and actuation part is arranged and adapted such that, when the elongate engagement and actuation part is arranged adjacent to each of the multiplicity of flexible STMs, the at least two engagement protrusions each mechanically interact with one of the flexible STMs such that, when a slack occurs in one of the flexible STMs, a resulting motion of the respective STM is transferred mechanically to the elongate engagement and actuation part. Such mechanical interaction between the engagement protrusions and the STMs might be established via a mechanical engagement of the protrusions into for example recesses comprised in the STM or in a fixation arrangement for fixing the STM at a fixed support structure of the elevator arrangement. The sensor of the monitoring device is arranged and adapted such as to detect the motion of the elongate engagement and actuation part. The monitoring device proposed herein is characterized by the fact that the elongate engagement and actuation part comprises a plurality of screws forming its engagement protrusions.

[0008] Ideas underlying embodiments of the present invention may be interpreted as being based, inter alia, on the following observations and recognitions.

[0009] As described in further details further below, slack detecting monitoring devices have been proposed in which an elongate engagement and actuation part may at the same time be in contact with several STMs and may be used for detecting any motion of the STMs which is a result of slack in one or more of the STMs. Such conventional monitoring devices generally use an elongate engagement and actuation part which is made by punching and bending a metal sheet into a desired configuration. In such conventional elongate engagement and actuation part, the engagement protrusion is typically realized as a single bended portion or two bended portions of the metal sheet which extend in a longitudinal direction of the elongate engagement and actuation part. When installing such monitoring device, this bended portion has to be precisely adjusted such as to come into close contact with the STMs to be monitored.

[0010] However, it has been observed that, upon installing such conventional monitoring device, it may be difficult to precisely arrange the bended portion of the elongate engagement and actuation member with sufficient precision.

[0011] It is therefore proposed to implement the engagement protrusion of the elongate engagement and actuation part in a different manner. Particularly, it is proposed to form the multiple engagement protrusions of the elongate engagement and actuation part by means of a plurality of screws. The positioning of such screws may be easily adapted upon installing the monitoring device and may therefore, inter alia, increase a reliability of the monitoring device in detecting slack of the STMs.

[0012] According to an embodiment, the elongate engagement and actuation part comprises an elongate

body in which each of the screws is fixed such that it protrudes in a protrusion direction being transverse to a longitudinal direction of the elongate body. In such embodiment, the screws may for example be screwed into the elongate body such that upon further screwing a screw its extension into the protrusion direction may be modified.

[0013] In other words, the elongate engagement and actuation part may be established with an elongate body into which several screws are screwed and may therefore form the engagement protrusions. Therein, the extension dimensions of these engagement protrusions may be modified by more or less screwing, i.e. tightening or loosening, each of the screws.

[0014] Accordingly, the extension dimensions of each of the screws forming the engagement protrusions may be precisely adapted such as to come into close contact or into direct mechanical contact with one of the STMs and/or a fixation arrangement of such STMs. Therein, each screw may be precisely position independently of other screws.

[0015] According to an embodiment, the elongate body comprises a metal sheet which may have an advantageous thickness of for example at least 3mm. The metal sheet may be a steel sheet. On the one hand, such metal sheet may easily be manufactured and brought into a required shape for example by punching and bending the metal sheet. Thereby, the elongate body may be produced in a simple and cost-effective manner. On the other hand, the elongate body may be provided with a sufficient mechanical strength.

[0016] According to a specific embodiment, the elongate body comprises an angled metal sheet comprising a first bracket at which the screws are fixed and a second bracket a motion of which is determined by the sensor of the monitoring device. Such angled configuration of the elongate body may be beneficial in that, on the one hand, the elongate engagement and actuation part may be easily arranged with the first bracket of the elongate body being close to a side surface for example of the STMs and the second bracket of the elongate body being suitably arranged relative to the sensor such that the sensor may easily detect its motion.

[0017] According to a further embodiment, the sensor is a switch which is adapted for being mechanically actuated upon the motion of the elongate engagement and actuation member. In other words, the sensor may be a mechanical switch which, for example, may be brought or held by the elongate engagement and actuation part into a first switching state when there is no slack in the monitored STMs and which comes into a second switching state when slack occurs in at least one of the STMs. Such mechanically actuated sensor may be relatively cheap, robust and/or easily installed.

[0018] However, in alternative embodiments, the sensor may be any other type of sensor as long as being capable of detecting a specific motion of the elongate engagement and actuation part. For example, the sensor may be an optical sensor, an electrical sensor, a magnetic sensor, an inductive sensor, a capacitive sensor, etc.

[0019] According to an embodiment, the screws forming the engagement protrusions are thread forming screws. Such thread forming screws may be easily screwed into corresponding openings within for example a metal sheet forming the elongate body of the elongate engagement and actuation part.

[0020] A typical diameter of the screws can be e.g. between 3mm and 30mm, preferably between 5mm and 15mm. A typical length can be between 10mm and 200mm, preferably between 20mm and 100mm.

[0021] According to a further embodiment, each of the screws forming the engagement protrusions may comprise a lock nut for fixing its extension position in the protrusion direction. Using such lock nuts, the screws may be easily fixed in a reliable manner and a risk of undesired releasing of any screw or undesired displacing of any screw may be minimized.

[0022] According to a further aspect of the invention, an elevator arrangement is proposed, the elevator arrangement comprising a cabin, multiple suspension and traction media supporting the cabin and a fixation arrangement for fixing the multiple suspension and traction media to a fixed support of the elevator arrangement. Furthermore, the elevator arrangement comprises a monitoring device according to embodiments of the above first aspect of the invention. Due to the provision of such monitoring device, any slack in one or more of the multiple STMs supporting the cabin may be detected in a reliable manner.

[0023] According to an embodiment, the monitoring device is adapted and arranged such that its screws forming the engagement protrusions engage with end portions of the multiple STMs and/or with the fixation arrangement. In other words, the monitoring device may be fixed with respect to the STMs in such a manner that any slack of at least one of the STMs results in a motion of at least one of the STMs and/or a motion of the fixation arrangement fixing the STMs and the screws forming the engagement protrusions interact or engage with the STMs and/or the fixation arrangement in such a manner that this resulting motion may be detected by the sensor of the monitoring device.

[0024] According to a third aspect of the invention, a method for installing a monitoring device according to embodiments of the above first aspect is proposed. The method is specifically adapted for correctly detecting slack in an arrangement comprising a multiplicity of flexible STMs of an elevator arrangement. For this purpose, the method comprises arranging the elongate engagement and actuation part of the monitoring device at a position adjacent to each of multiple holders, each holder being fixedly attached to one of the multiplicity of flexible STMs and being held at a fixation arrangement for fixing the STMs to a fixed support structure of the elevator arrangement. Then, each of the screws of the elongate

engagement and actuation part is screwed into a configuration in which the respective screw comes either into mechanical contact or into close proximity of less than 1mm, preferably less than 0.5mm, to an associated one the holders.

[0025] Using such installation method, the monitoring device may be easily installed in an elevator arrangement and its screws forming the engagement protrusions may be precisely positioned such as to achieve high reliability in detecting any slack of STMs.

[0026] It shall be noted that possible features and advantages of embodiments of the invention are described herein partly with respect to a monitoring device, partly with respect to an elevator arrangement comprising such monitoring device and partly with respect to a method for installing such monitoring device. One skilled in the art will recognize that the features may be suitably transferred from one embodiment to another and features may be modified, adapted, combined and/or replaced, etc. in order to come to further embodiments of the invention.

[0027] In the following, advantageous embodiments of the invention will be described with reference to the enclosed drawings. However, neither the drawings nor the description shall be interpreted as limiting the invention.

Fig. 1 shows an elevator arrangement.

Fig. 2 shows a perspective view onto a prior art monitoring device.

Fig. 3 shows a side view of the monitoring device of Fig. 2.

Fig. 4 shows a side view of a monitoring device according to an embodiment of the present invention.

Fig. 5 shows a perspective view of an elongate engagement and actuation part for a monitoring device according to an embodiment of the invention.

Fig. 6 shows a top view onto the elongate engagement and actuation part of Fig. 5.

Fig. 7 shows a side view of a monitoring device according to an alternative embodiment of the invention.

Fig. 8 shows a perspective view of an elongate engagement and actuation part for the monitoring device of Fig. 7.

Fig. 9 shows a side view of a monitoring device according to a further alternative embodiment of the present invention.

Fig. 10 shows a side view of a monitoring device according to another alternative embodiment of the present invention.

[0028] The figures are only schematic and not to scale. Same reference signs refer to same or similar features.

[0029] Fig. 1 shows an elevator arrangement 100 comprising a cabin 102 and a counterweight 104 arranged in an elevator shaft 106. Suspension and traction media 108 comprising for example a plurality of belts or ropes support the cabin 102 and the counterweight 104. First ends of the STMs are fixed to a fixed support structure 112 of the elevator arrangement 100. Second ends of the STMs 108 are fixed to a support structure 114 of the elevator arrangement 100 via a fixation arrangement 116. The support structures 112, 114 may be part of a wall of the elevator shaft 106 or fixed thereto.

[0030] Fig. 2 shows a perspective view of the fixation arrangement 116 comprising a monitoring device 1 for detecting slack in an arrangement comprising the multiple STMs 108. The fixation arrangement 116 comprises a strong bar 118 to which, in this example, three STMs 108 are connected via holders 120. The holders 120 are cylindrical components having a conical surface 122 at their upper ends. The STMs 108 are fixed to the holders 120 via connection means 126 and long stable fixation screws 128.

[0031] The monitoring device 1 comprises an elongate engagement and actuation part 3 which is arranged parallel to the bar 118. The elongate engagement and actuation part 3 extends from an outermost first holder 120' to an opposite outermost last holder 120"'. The elongate engagement and actuation part 3 is made from a punched and bent metal sheet and comprises a bent section 5 which engages with the conical surface 122 of each of the holders 120.

[0032] Fig. 3 shows a side view of the monitoring device 1 of Fig. 2. The bent portion 5 of the elongate engagement and actuation part 3 comes into close contact and/or engages with the conical surface 122 of the holder 120. Furthermore, a sensor 7 is fixed with respect to the elongate engagement and actuation part 3. The sensor 7 is arranged vertically and may be mechanically actuated by vertically displacing an actuation hub 23.

[0033] Accordingly, if the elongate engagement and actuation part 3 is displaced due to a motion of one of the STMs 108 as result of an occurring slack in this STM 108, such motion may be detected by the sensor 7. The sensor 7 may then transmit a corresponding signal via e.g. a signal line 109 to a control (not shown) of the elevator arrangement 100. Upon detection of such slacking STM, the control may e.g. de-activate the elevator arrangement 100 or initiate an emergency action.

[0034] In the approach shown in Figs. 2 and 3, the bent portion 5 extends essentially along the entire longitudinal length of the elongate engagement and actuation part 3 and comes into contact with each of the conical surfaces 122 of each of the three holders 120 connected to the three STMs 108. In principle, several bent portions 5 may be provided along the longitudinal extension of the elongate engagement and actuation part 3. However, even then, typically one single bent portion 5 contacts two or

more of the holders 120", 120'" at their respective conical surfaces 122.

[0035] Upon installing such monitoring device 1, it may be difficult to position the elongate engagement and actuation part 3 and its bent portion(s) 5 with a sufficient accuracy with respect to the conical surfaces 122 of the holders 120', 120", 120"'. Particularly, it has been observed that such positioning should be as precise such as a spacing between the bent portion 5 of the elongate engagement and actuation part 3 and a conical surface 122 is smaller than 1mm, preferably smaller than 0.5mm, for each of the holders 120', 120", 120"'connected to the STMs 108.

[0036] However, with a single bent portion 5 being comprised in the elongate engagement and actuation part 3 in order to monitor slack-initialized motion of each of two or more holders 120', 120", 120'" of STMs 108, such precise positioning may be a difficult task.

[0037] Therefore, as shown with a first embodiment depicted in Fig. 4, a monitoring device 1 is proposed in which multiple screws 11 are provided for forming engagement protrusions which, in the example of Figs. 2 and 3, was formed by the bent portion 5.

[0038] As shown in the perspective view of Fig. 5 and the top view of Fig. 6, the elongate engagement and actuation part 3 carries the multiple screws 11 at positions corresponding to the positions of the holders 120 fixing the STMs 108 at the fixation arrangement 116. The screws 11 are arranged in a line and spaced along the longitudinal direction of the elongate engagement and actuation part 3. An extension direction of the screws 11 is transverse, preferably perpendicular, to a surface of the elongate engagement and actuation part 3. Furthermore, the extension direction of the screws 11 is transverse, preferably perpendicular, to an extension direction of the STMs 108 or to a middle axis of the holders 120. At a rear part of each screw 11, a lock nut 27 is provided which may be tensioned for reliable fixing of the positioning of the screw 11 with respect to the rest of the elongate engagement and actuation part 3.

[0039] The elongate engagement and actuation part 3 comprises an elongate body 13 formed by an angled metal sheet comprising a first bracket 15 at which the screws 11 are fixed and a second bracket 17 extending transverse to the first bracket 15. The elongate body 13 may be made from a single metal sheet by punching and/or bending. The elongate body 13 may comprise several through holes into which the screws 11 are inserted.

[0040] At the second bracket 17, hinge extensions 19 are provided which may be accommodated within a hinge support 21 such that the elongate body 13 may pivot around the hinge extensions 19. Accordingly, when e.g. one of the holders 120 moves due to an STM 108 attached thereto becoming slack, its motion is transferred to the elongate body 13 via the screw 11 engaging the holder's conical surface 122, which, in the embodiment of Fig. 4, is part of a recess 124 in the holder 120. In such motion, the elongate body 13 will pivot around an axis defined through the hinge extensions 19. Accordingly, the first and second brackets 15, 17 will be displaced.

[0041] An extension portion 21 of the second bracket 17 extending further to right in Fig. 4 is configured to actuate an actuation hub 23 of the sensor 7. In case the second bracket 17 is displaced in a pivoting motion, such displacement may be detected for example by the sensor 7 due to its actuation hub 23 being mechanically actuated by the extension portion 21.

[0042] In other words, if an STM 108 (not shown in Fig. 4) fixed to the holder 120 becomes slacking and therefore no tensioning force is applied anymore to the holder 120, the holder 120 may move in a vertical direction. Upon such motion, the elongate engagement and actuation part 3 will also be displaced as its screws 11 mechanically cooperate with the holder 120 for example along its conical surface 122, i.e., in the example of Fig. 4, the screws 11 engage into a recess 124 formed at the holder 120. Upon installing the elongate engagement and actuation part 3, each of the screws 11 may be screwed, i.e. tightened or loosened, into a position such that its end surface comes into mechanical contact or at least into very closed proximity of e.g. less than 0.5mm to an associated holder 120, particularly to the conical surface 122 of the holder 120.

[0043] As, for each of the STMs 108 comprised in the arrangement to be monitored by the monitoring device 1, screws 11 are provided at the elongate engagement and actuation part 3 for forming its engagement protrusions, each of these engagement protrusions may be accurately positioned by adjusting a screwing position of each screw 11.

[0044] Figs. 7 to 10 show further embodiments of the monitoring device 1 and its components wherein specific adaptions and modifications of the components and their functions as described with respect to the embodiment shown in Figs. 4 to 6 are substantially self-explaining to one skilled in the art from the figures.

[0045] For example, in the embodiment of Fig. 7 and 8, the sensor 7 is mounted horizontally. An actuation hub 23 of the sensor 7 may be actuated by a slanted appendix 25 of the actuation extension 21 of the second bracket 17 of the elongate body 13.

[0046] In the embodiment of Fig. 9, the sensor 7 is mounted horizontally at a different position at an upper portion of the first bracket 15. In the embodiment of Fig. 10, the sensor 7 is mounted vertically at a further different position underneath the elongate body 13.

[0047] Finally, it should be noted that the term "comprising" does not exclude other elements or steps and the "a" or "an" does not exclude a plurality. Also elements described in association with different embodiments may be combined. It should also be noted that reference signs in the claims should not be construed as limiting the scope of the claims.

Claims

1. Monitoring device (1) for detecting slack in an arrangement comprising a multiplicity of flexible suspension and traction media (108) of an elevator arrangement (100), the monitoring device (1) comprising:

   an elongate engagement and actuation part (3);
   a sensor (7);
   wherein the elongate engagement and actuation part (3) comprises at least two engagement protrusions extending in a protrusion direction;
   wherein the elongate engagement and actuation part (3) is arranged and adapted such that, when the elongate engagement and actuation part (3) is arranged adjacent to each of the multiplicity of flexible suspension and traction media (108), the at least two engagement protrusions each mechanically interact with one of the flexible suspension and traction media (108) such that, when a slack occurs in one of the flexible suspension and traction media (108), a resulting motion of the respective flexible suspension and traction medium (108) is transferred mechanically to the elongate engagement and actuation part (3);
   wherein the sensor (7) is arranged and adapted such as to detect the motion of the elongate engagement and actuation part (3);
   wherein the elongate engagement and actuation part (3) comprises a plurality of screws (11) forming the engagement protrusions.

2. Monitoring device of claim 1, wherein the elongate engagement and actuation part (3) comprises an elongate body (13) in which each of the screws (11) is fixed such that it protrudes in a protrusion direction transverse to a longitudinal direction of the elongate body (13).

3. Monitoring device of claim 2, wherein the screws (11) are screwed into the elongate body (13) such that upon further screwing a screw (11) its extension into the protrusion direction may be modified.

4. Monitoring device of one of claims 2 and 3, wherein the elongate body (13) comprises a metal sheet.

5. Monitoring device of claim 4, wherein the metal sheet has a thickness of at least 3mm.

6. Monitoring device of one of claims 2 to 4, wherein the elongate body (13) comprises an angled metal sheet comprising a first bracket (15) at which the screws (11) are fixed and a second bracket (17) a motion of which is determined by the sensor (7).

7. Monitoring device of one of the preceding claims, wherein the sensor (7) is a switch adapted for being mechanically actuated upon the motion of the elongate engagement and actuation part (3).

8. Monitoring device of one of the preceding claims, wherein the screws (11) are thread forming screws.

9. Monitoring device of one of the preceding claims, wherein each screw comprises a lock nut (27) for fixing its extension position in the protrusion direction.

10. Elevator arrangement (100) comprising:

    a cabin (102);
    multiple suspension and traction media (108) supporting the cabin (102);
    a fixation arrangement (116) for fixing the multiple suspension and traction media (108) to a fixed support structure (114) of the elevator arrangement (100);
    a monitoring device (1) according to one of claim 1 to 9.

11. Elevator arrangement of claim 10, wherein the monitoring device (1) is adapted and arranged such that its screws (11) forming the engagement protrusions engage at least with one of end portions of the multiple suspension and traction media (108) and with the fixation arrangement (116).

12. Method for installing a monitoring device (1) according to one of claims 1 to 9 for correctly detecting slack in an arrangement comprising a multiplicity of flexible suspension and traction media (108) of an elevator arrangement (100), the method comprising:

    arranging the elongate engagement and actuation part (3) of the monitoring device (1) at a position adjacent multiple holders (120), each holder (120) being fixed attached to one of the multiplicity of flexible suspension and traction media (108) and being held at a fixation arrangement (116) for fixing the multiple suspension and traction media (108) to a fixed support structure (114) of the elevator arrangement (100);
    screwing each of the screws (11) of the elongate engagement and actuation part (3) into a configuration in which the respective screw (11) comes into one of mechanical contact and close proximity of less than 1 mm to an associated one of the holders (120).

Fig. 1

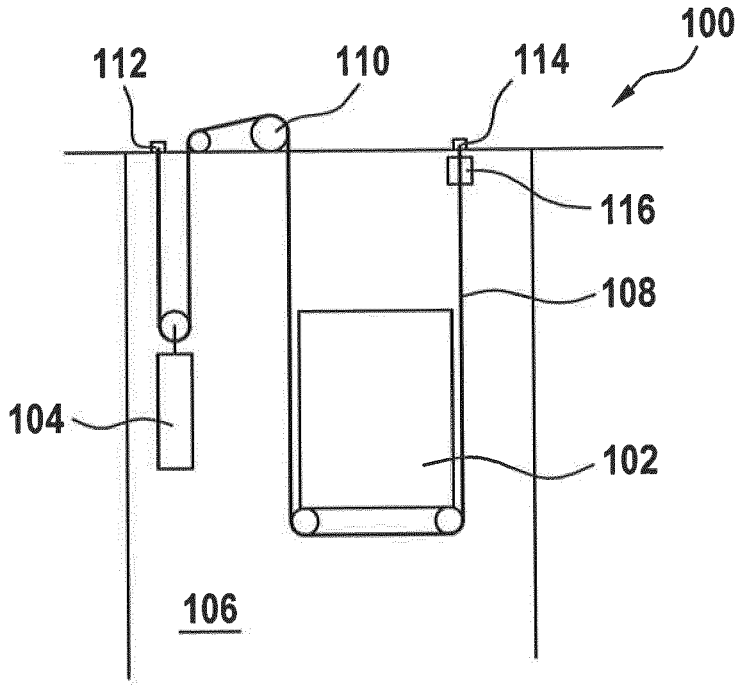

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Fig. 2

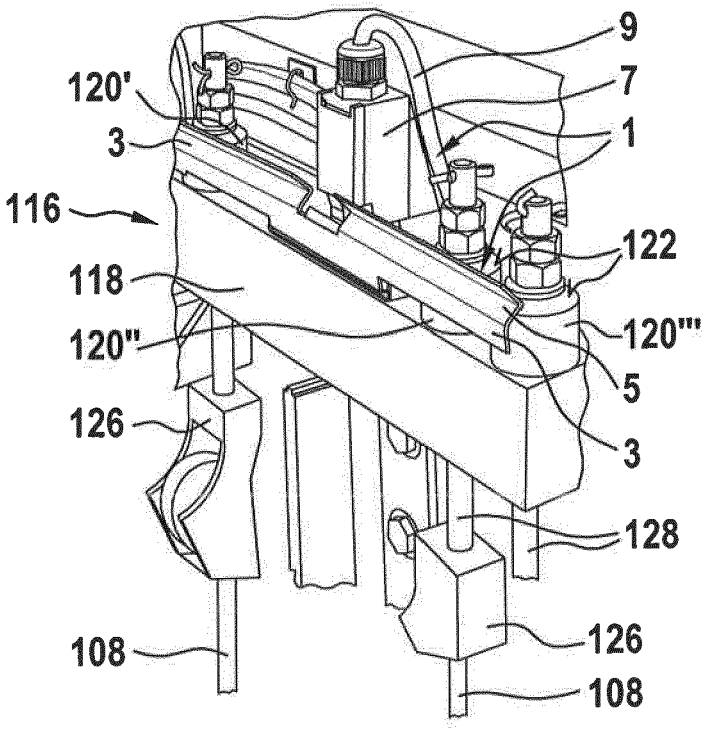
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Fig. 3

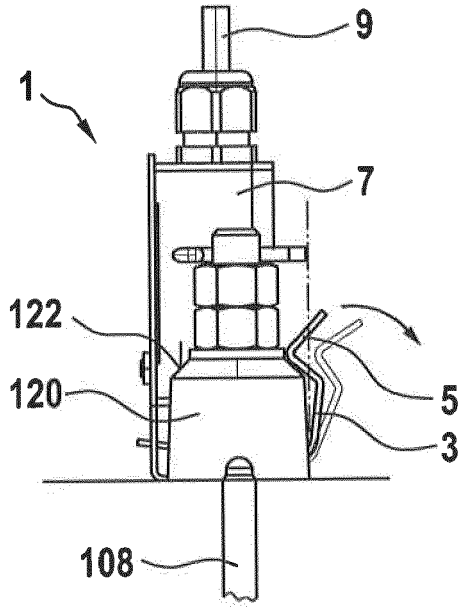

Fig. 4

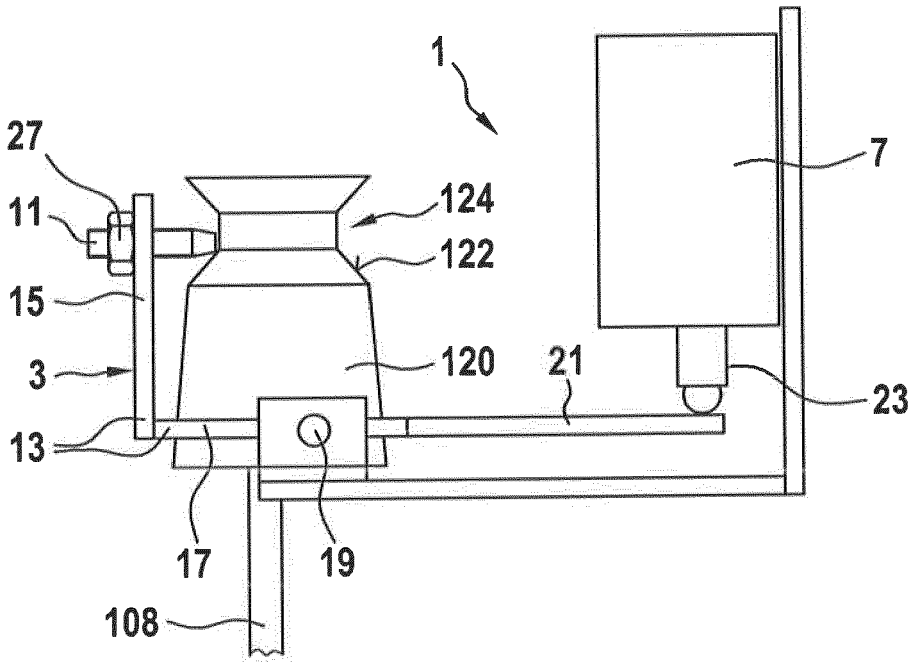

Fig. 5

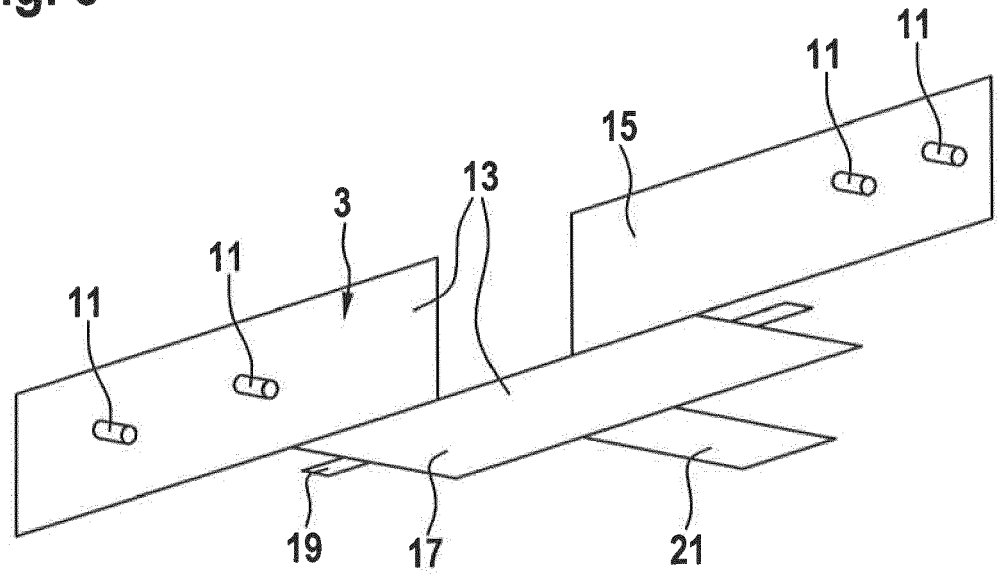

Fig. 6

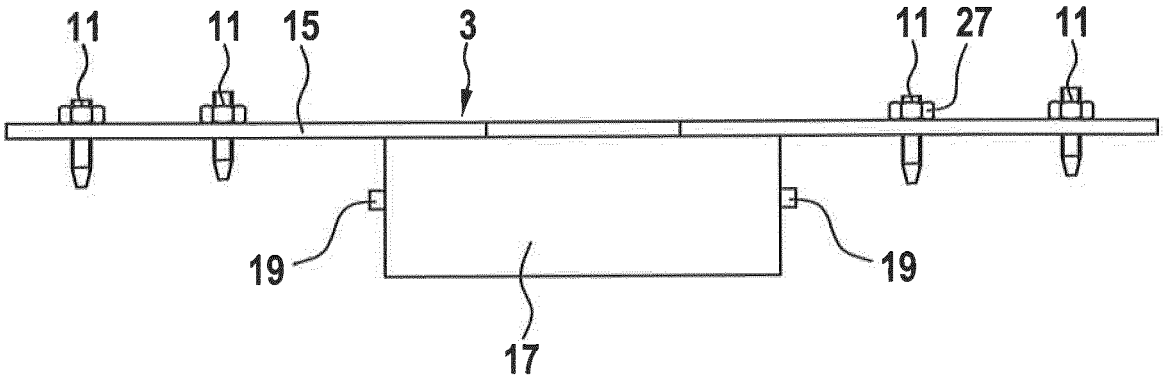

Fig. 7

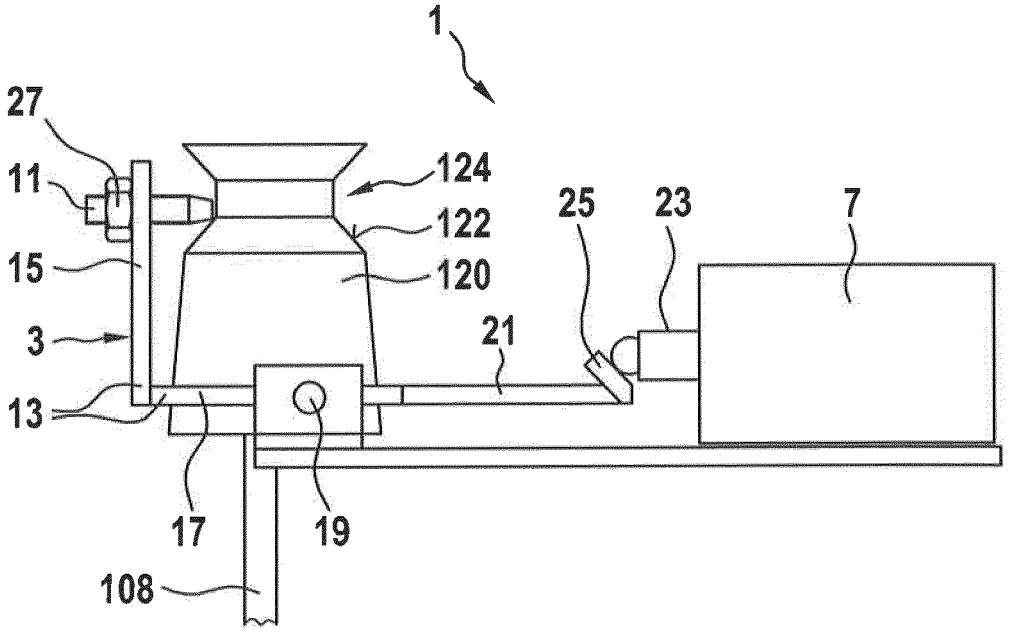
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Fig. 8

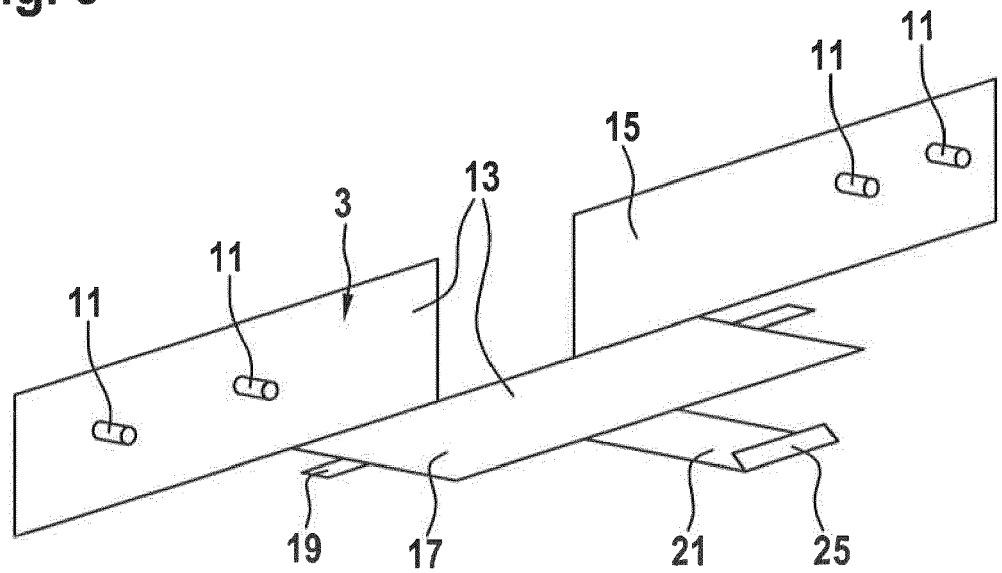
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Fig. 9

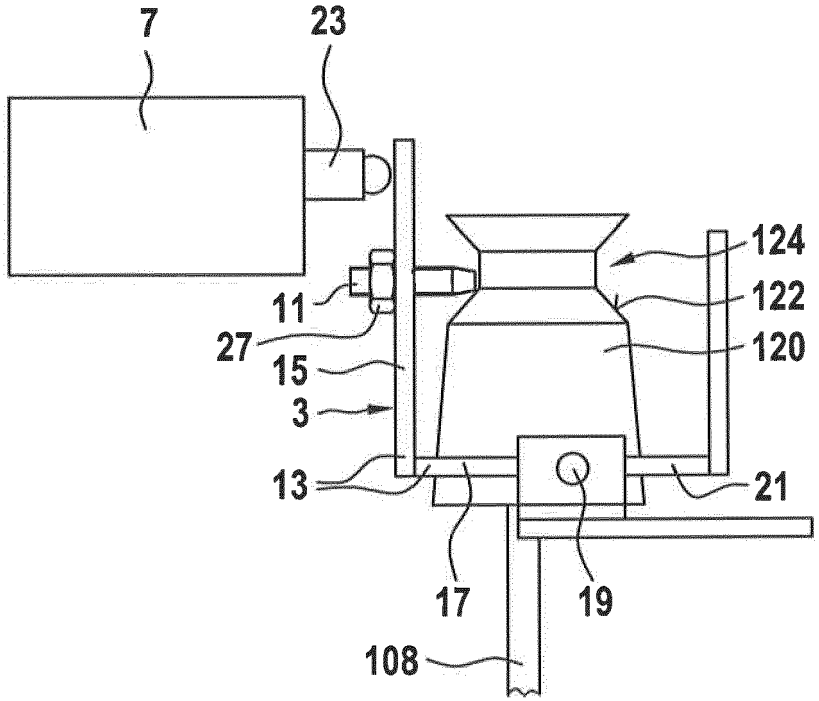
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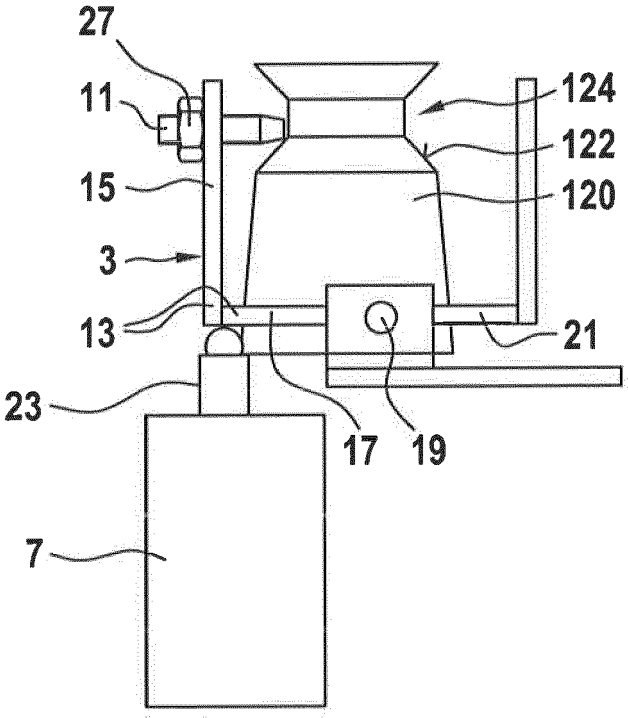
Fig. 10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Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 8151

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	CN 202 063 618 U (NANTONG 10TH GROUP ENGINEERING CO LTD) 7 December 2011 (2011-12-07) * abstract; figure 1 *	1-12	INV. B66B5/12
X	CN 203 237 876 U (NINGBO HONGDA ELEVATOR CO LTD) 16 October 2013 (2013-10-16) * abstract; figures 1,2 *	1-4,7, 9-12	
X	DD 154 288 A1 (PIETZSCH JUERGEN; SCHMIDT KLAUS) 10 March 1982 (1982-03-10) * page 3, lines 6-18; figure 3 *	1-4,9-12	

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	11 January 2016	Janssens, Gerd

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 17 8151

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CN 202063618 U	07-12-2011	NONE	
CN 203237876 U	16-10-2013	NONE	
DD 154288 A1	10-03-1982	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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