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(54) OVERSPEED DETECTION AND GUIDING DEVICES FOR ELEVATOR SYSTEMS

(57) Overspeed detection systems for elevators are provided. The overspeed detection systems include a roller guide frame including a mounting base, a first roller supported on the mounting base, the first roller having a first roller wheel configured to engage with and rotate along a guide rail when installed in an elevator system, a first overspeed device arranged within the first roller wheel, the first overspeed device having a detectable element, and a detector defining a detection zone and arranged to detect the detectable element within the detection zone when the first roller wheel rotates at or above a threshold rotational speed.

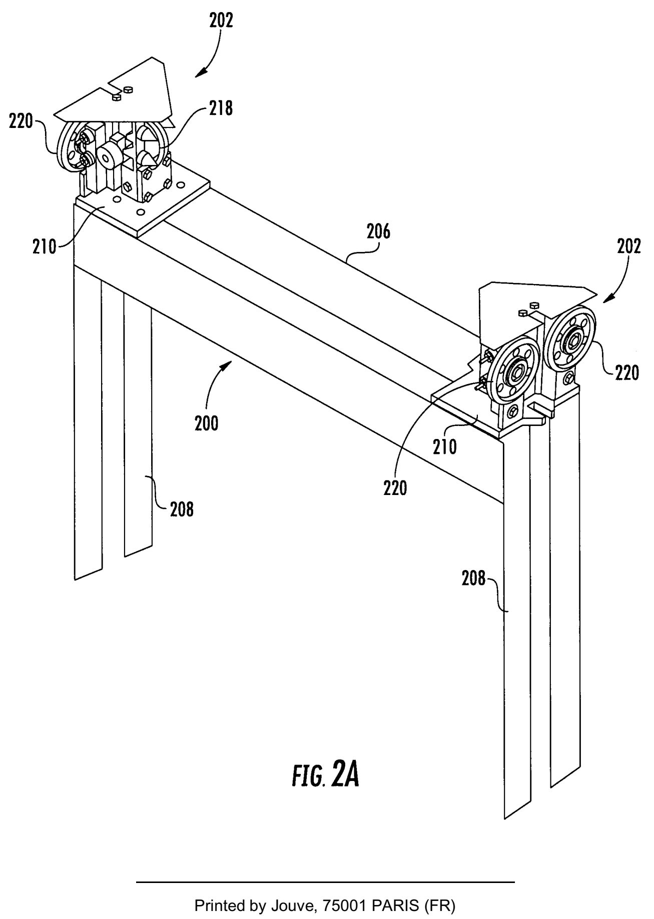

FIG. 2A

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Description

[0001] The subject matter disclosed herein generally relates to elevator systems and, more particularly, to sensing elevator car guiding devices for elevator systems to connect an elevator car to a guide rail.

[0002] Elevator systems are used to transport passengers within buildings between floors of the building. Because of the enclosed space, speed of travel, and other concerns, monitoring the speed of travel and ensuring the safety of such passengers is a priority. Typically elevator systems include overspeed governors that are arranged to control (e.g., stop) the movement of an elevator car during an overspeed event. Various speed detection components can be used to monitor the speed of travel, and if excessive speeds are detected, actuation of a braking system may be implemented. In operation, a governor device engages roller(s), locking the elevator car to the guide rails should the elevator car travel at an excessive speed (e.g., descend). That is, in an overspeed event, a safety actuation operation is performed, such as engaging rollers, brakes, etc. in order to slow a travel speed of an elevator car (or elevator system counterweight, as appreciated by those of skill in the art).

[0003] As elevator systems continue to improve, various safety and cost benefits are considered. For example, the reduction of the number of components, reducing access to an elevator shaft, and maintaining safety are all considerations. Accordingly, improved systems for providing safe overspeed detection and safety actuation (e.g., braking operations) are desirable.

[0004] According to some embodiments, overspeed detection systems for elevator systems are provided. The overspeed detection systems include a roller guide frame including a mounting base, a first roller supported on the mounting base, the first roller having a first roller wheel configured to engage with and rotate along a guide rail when installed in an elevator system, a first overspeed device arranged within the first roller wheel, the first overspeed device having a detectable element, and a detector defining a detection zone and arranged to detect the detectable element within the detection zone when the first roller wheel rotates at or above a threshold rotational speed.

[0005] In addition to one or more of the features described above, or as an alternative, further embodiments of the overspeed detection systems may include that the first overspeed device comprises a track within the first roller wheel with the detectable element moveable within the track.

[0006] In addition to one or more of the features described above, or as an alternative, further embodiments of the overspeed detection systems may include that the first overspeed device comprises a biasing element arranged to urge the detectable element away from the detection zone when the first roller wheel rotates at rotational speed below the threshold rotational speed.

[0007] In addition to one or more of the features described above, or as an alternative, further embodiments of the overspeed detection systems may include that the biasing element is a spring.

[0008] In addition to one or more of the features described above, or as an alternative, further embodiments of the overspeed detection systems may include that the detectable element is formed of a first material and the biasing element is formed of a second material that is different from the first material.

[0009] In addition to one or more of the features described above, or as an alternative, further embodiments of the overspeed detection systems may include that the detectable element is a steel ball.

[0010] In addition to one or more of the features described above, or as an alternative, further embodiments of the overspeed detection systems may include a switch operably connected to the detector such that when the detector detects the presence of the detectable element, the switch is actuated.

[0011] In addition to one or more of the features described above, or as an alternative, further embodiments of the overspeed detection systems may include that least one additional overspeed device is arranged within the first roller wheel and arranged to balance the first roller wheel during rotation.

[0012] In addition to one or more of the features described above, or as an alternative, further embodiments of the overspeed detection systems may include that the at least one additional overspeed device is arrange diametrically opposite the first overspeed device.

[0013] In addition to one or more of the features described above, or as an alternative, further embodiments of the overspeed detection systems may include that the at least one additional overspeed device comprises a detectable element and a biasing element.

[0014] According to some embodiments, elevator system guiding devices are provided. The elevator system guiding devices include an overspeed detection system of any of the above embodimets.

[0015] In addition to one or more of the features described above, or as an alternative, further embodiments of the elevator system guiding devices may include that the elevator system guiding device is a guiding device of an elevator car or a counterweight.

[0016] According to some embodiments, elevator systems are provided. The elevator systems include an elevator shaft having a plurality of landings, an elevator car movable within the elevator shaft along a car guide rail, a counterweight movable within the elevator shaft along a counterweight guide rail, and the overspeed detection system of any of the preceding embodiments arranged to detect an overspeed of at least one of the elevator car and the counterweight.

[0017] In addition to one or more of the features described above, or as an alternative, further embodiments of the elevator systems may include that when the first roller wheel is detected rotating at or above the threshold rotational speed, a brake is applied to slow movement of the elevator car or the counterweight.

[0018] The foregoing features and elements may be combined in various combinations without exclusivity, unless expressly indicated otherwise. These features and elements as well as the operation thereof will become more apparent in light of the following description and the accompanying drawings. It should be understood, however, that the following description and drawings are intended to be illustrative and explanatory in nature and non-limiting.

[0019] The subject matter is particularly pointed out and distinctly claimed at the conclusion of the specification. The foregoing and other features, and advantages of the present disclosure are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1A is a schematic illustration of an elevator system that may employ various embodiments of the disclosure;

FIG. 1B is a side schematic illustration of an elevator car of FIG. 1A attached to a guide rail track;

FIG. 2A is a partial isometric illustration of an elevator car frame having roller guides in accordance with an embodiment of the present disclosure mounted thereto;

FIG. 2B is a plan view schematic illustration of one of the roller guides of FIG. 2A;

FIG. 3A is a schematic illustration of a roller having an overspeed detection system in accordance with an embodiment of the present disclosure, shown in a first state;

FIG. 3B is a schematic illustration of the roller and overspeed detection system of FIG. 3A shown in a second state;

FIG. 4 is a schematic illustration of an elevator system guiding device in accordance with an embodiment of the present disclosure.

[0020] FIG. 1A is a perspective view of an elevator system 101 including an elevator car 103, a counterweight 105, a roping 107, a guide rail 109, a machine 111, a position encoder 113, and a controller 115. The elevator car 103 and counterweight 105 are connected to each other by the roping 107. The roping 107 may include or be configured as, for example, ropes, steel cables, and/or coated-steel belts. The counterweight 105 is configured to balance a load of the elevator car 103 and is configured to facilitate movement of the elevator car 103 concurrently and in an opposite direction with respect to the counterweight 105 within an elevator shaft 117 and along the guide rail 109.

[0021] The roping 107 engages the machine 111, which is part of an overhead structure of the elevator system 101. The machine 111 is configured to control movement between the elevator car 103 and the counterweight 105. The position encoder 113 may be mounted on an upper sheave of a speed-governor system 119 and may be configured to provide position signals related to a position of the elevator car 103 within the elevator shaft 117. In other embodiments, the position encoder 113 may be directly mounted to a moving component of the machine 111, or may be located in other positions and/or configurations as known in the art.

[0022] The controller 115 is located, as shown, in a controller room 121 of the elevator shaft 117 and is configured to control the operation of the elevator system 101, and particularly the elevator car 103. For example, the controller 115 may provide drive signals to the machine 111 to control the acceleration, deceleration, leveling, stopping, etc. of the elevator car 103. The controller 115 may also be configured to receive position signals from the position encoder 113. When moving up or down within the elevator shaft 117 along guide rail 109, the elevator car 103 may stop at one or more landings 125 as controlled by the controller 115. Although shown in a controller room 121, those of skill in the art will appreciate that the controller 115 can be located and/or configured in other locations or positions within the elevator system 101.

[0023] The machine 111 may include a motor or similar driving mechanism. In accordance with embodiments of the disclosure, the machine 111 is configured to include an electrically driven motor. The power supply for the motor may be any power source, including a power grid, which, in combination with other components, is supplied to the motor.

[0024] Although shown and described with a roping system, elevator systems that employ other methods and mechanisms of moving an elevator car within an elevator shaft may employ embodiments of the present disclosure. FIG. 1A is merely a non-limiting example presented for illustrative and explanatory purposes.

[0025] FIG. 1B is a side view schematic illustration of the elevator car 103 as operably connected to the guide rail 109. As shown, the elevator car 103 connects to the guide rail 109 by one or more guiding devices 127. The guiding devices 127 may be guide shoes, rollers, etc., as will be appreciated by those of skill in the art. The guide rail 109 defines a guide rail track that has a base 129 and a blade 131 extending therefrom (see also FIG. 2B, a guide rail 212 having a rail base 214 and a rail blade 216). The guiding devices 127 of the elevator car 103 are configured to run along and/or engage with the blade 131 of the guide rail 109. The guide rail 109 mounts to a wall 133 of the elevator shaft 117 (shown in FIG. 1A) by one or more brackets 135. The brackets 135 are configured to fixedly mount to the wall 133, such as by bolts, fasteners, etc. as known in the art. The base 129 of the guide rail 109 fixedly attaches to the brackets 135, and thus the guide rail 109 can be fixedly and securely mounted to the wall 133. As will be appreciated by those of skill in the art, a guide rail of a counterweight of an elevator system may be similarly configured.

[0026] Embodiments provided herein are directed to apparatuses, systems, and methods related to elevator speed information, and particularly to monitoring for overspeed within an elevator system. Typically, an elevator system may be equipped with an overspeed monitoring system (e.g., speed sensors, position sensors, elements incorporated into the machine, etc.). However, embodiments of the present disclosure are directed to incorporating an elevator speed monitoring system into the roller guides (e.g., for elevator cars and/or couterweights).

[0027] Turning now to FIGS. 2A-2B, schematic illustrations of elevator car guiding devices 202 in accordance with a non-limiting embodiment of the present disclosure are shown. FIG. 2A is a partial isometric illustration of an elevator car frame 200 having two elevator car guiding devices 202 installed thereon. FIG. 2B is a top-down schematic illustration of an elevator car guiding device 202 as engaged with a guide rail 212 of an elevator system. The elevator car frame 200 includes a crosshead frame 206 extending between vertical stiles 208. The elevator car guiding devices 202 are mounted to at least one of the crosshead frame 206 and the vertical stiles 208 at respective mounting bases 210. Each mounting base 210 defines at least part of a roller guide frame that is used to mount and support rolling components to an elevator car.

[0028] The elevator car guiding devices 202 are each configured to engage with and move along a respective guide rail 212 (e.g., as shown in FIG. 2B). The guide rail 212 has a rail base 214 and a rail blade 216 and the elevator car guiding devices 202 engage with and move along the rail blade 216 of the guide rail 212. For example, the elevator car guiding device 202, as shown in FIG. 2B, includes a first roller 218 and two second rollers 220. In the present configuration and arrangement, as appreciated by those of skill in the art, the first roller 218 is a side-to-side roller and the second rollers 220 are front-to-back rollers. The first roller 218 of one elevator car guiding device 202 operates in concert with a first roller of another elevator car guiding device to prevent side-to-side movement (e.g., within the elevator shaft). Although a specific configuration and arrangement is shown in FIGS. 2A-2B, those of skill in the art will appreciate that embodiments provided herein are applicable to various other elevator car guiding device configurations/arrangements. Each of the first and second rollers 218, 220 include roller wheels as known in the art.

[0029] The rollers 218, 220 are movably or rotatably mounted to the mounting base 210 by a first support bracket 222 and second support brackets 224, respectively. As will be appreciated by those of skill in the art, roller guides typically utilize wheels with rolling element bearings mounted on stationary pins (spindles) fixed to pivoting arms supported by the mounting base 210, which in turn interfaces with the car frame, as described above. The pivoting arm is retained by a stationary pivot pin fixed to the base. A spring is configured to provide a restoring force and a displacement stop (e.g., a bumper). The roller wheels contact the guide rails of the elevator system and spin with the vertical motion of the elevator car.

[0030] Although FIGS. 2A-2B are illustrated and discussed relative to an elevator car frame, and thus the elevator car guiding device 202 is for an elevator car, those of skill in the art will appreciate that similar constructions and guiding devices may be used for counterweights of elevator systems. Thus, the above embodiments are merely for illustrative and explanatory purposes, and not intended to be limiting.

[0031] In accordance with embodiments of the present disclosure, one or more the rollers 218, 220 may be configured with an overspeed detection system, as described herein. For example, in some embodiments, a sensor or detector may be positioned relative to a roller having a detectable element, wherein when the sensor detects the presence of the detectable element, an overspeed may be determined, and thus corrective action (e.g., application of brakes) may be taken in response to the overspeed condition.

[0032] Turning now to FIGS. 3A-3B, schematic illustrations of a roller 330 in accordance with an embodiment of the present disclosure are shown. The roller 330 may be used as a roller in an elevator car guiding device or in a counterweight guiding device of elevator systems. As noted, typical guiding devices of elevator systems include one or more rollers (typically three) that movably engage with a guide rail. The roller 330 shown in FIGS. 3A-3B may be used in any of the guiding devices, with one or more of the rollers thereof configured as shown in FIGS. 3A-3B.

[0033] The roller 330 includes a roller wheel 331 having a contact portion 332 and a rim 334 to which the contact portion 332 is mounted, attached, or part of. The contact portion 332 is part of the roller wheel 331 that contacts and runs along a guide rail of an elevator system. The rim 334 supports the contact portion 332 and fixedly mounts the roller 330 to a frame, such as shown and described above. An axle, shaft, or other rotating element (not shown) may connect to a support and/or frame when assembled as part of a guiding device. Although shown as two separate parts of the roller 330, the contact element 332 and the rim 334 may be a unitary or uniform body formed from a single material and/or mold. In some embodiments, the contact portion 332 may be a rubber material and the rim 334 may be metal.

[0034] The roller 330 is configured with a first overspeed device 336 and a second overspeed device 338. The overspeed devices 336, 338 are configured to respond to the rotational speed of the roller 330 such that an overspeed detection may be made when the roller 330 rotates at or above a predefined rotational speed.

[0035] The first overspeed device 336 includes a track

340, a detectable element 342, and a biasing element 344. The track 340 has a first end 346 and a second end 348. During normal operation, e.g., when the roller 330 is rotating at a first rotational speed S_1, which may be a rotational speed within normal operating speeds of the roller 330, the first overspeed device 336 is in a first state (e.g., as shown in FIG. 3A). To maintain the first overspeed device 336 in the first state, the biasing element 344 is configured or set to hold or bias the detectable element 342 into or toward the first end 346 of the track 340. However, if the rotational speed of the roller 330 meets or exceeds the predefined rotational speed (e.g., second rotation speed S_2 shown in FIG. 3B), the detectable element 342 may be forced toward the second end 346 of the track 340 and overcome the biasing force of the biasing element 344. As such, the detectable element 342 may move toward the second end 346 of the track 340.

[0036] To detect an overspeed condition of the roller 330, such as the second rotational speed S_2, a detector 350 is arranged adjacent to the roller 330. The detector 350 is selected to detect the presence of the detectable element 342 when the detectable element 342 is located within (or passes through) a detection zone 352. As such, the detectable element 342 is configured and/or selected for detection by the detector 350. Further, the range of the detection zone 352, the length of the track 340, the weight of the detectable element 342, and/or the biasing force of the biasing element 344 is configured or selected such that during normal speeds (e.g., first rotation speed S_1) the detectable element 342 does not pass through the detection zone 352. However, when the rotational speed of the roller 330 meets or exceeds a threshold value (e.g., an overspeed), the detectable element 342 moves into or through the detection zone 352 such that the detector 350 may be triggered (e.g., detect the presence of the detectable element 342).

[0037] In some embodiments, the detectable element 342 is selected to be made from a first material that is detectable or interactive with the detector 350 when within the detection zone 352. Further, the biasing element 344 may be formed from a second material that is different from the first material such that the presence of the biasing element within the detection zone 352 will not be detected by or interact with the detector 350. Further, it will be appreciated that the material of the roller wheel 331 will be a material that does not interact with or is detectable by the detector 350. Thus, it is only the detectable element 342 that is detectable by or interacts with the detector 350 when in the detection zone 352.

[0038] The detector 350 is operably connected to a switch 354, which in turn is connected to a safety circuit 356. The safety circuit 356 may be part of a safety chain of an elevator system and/or may operably connect the switch 354 to an electronic safety actuator (or other braking system). When the detector 350 is actuated by detection of the detectable element 342, the switch 354 may actuate (open or close depending on configuration) and thus trigger a safety response, such as a braking operation. As shown in FIGS. 3A-3B, the switch 354 is open during normal operation (FIG. 3A) and closed when an overspeed condition exists (FIG. 3B). In one non-limiting embodiment, the detectable element 342 is a steel ball and the biasing element 344 is a spring.

[0039] In operation, as the roller 330 rotates, centrifugal force will cause the detectable element 342 to apply a force to the biasing element 344. As the force applied by the detectable element 342 increases, the biasing element 344, in this embodiment, will compress, and the detectable element 342 will move radially outward along the track 340. When the detectable element 342 enters the detection zone 352, the detector 350 will detect the presence of the detectable element 342 and cause the switch 354 to change state (e.g., open or close) and thus trigger the safety response.

[0040] As noted above, the roller 330 includes a second overspeed device 338. The second overspeed device 338 may be formed substantially similar to the first overspeed device 338 and may be arranged diametrically opposite the first over speed device 338 (i.e., along the same diameter or opposing radial line of the roller 330). The second overspeed device 338 includes a track 358 with a detectable element 360 and a biasing element 362 within the track 358. The second overspeed device 338 is arranged to ensure balancing of the roller 330 during operation. However, in some embodiments, the second overspeed device 338 may be removed if other balancing compensation is provided within the roller 330.

[0041] Although shown in FIGS. 3A-3B with the biasing elements 344, 362 being compressed by the detectable elements 342, 360, such arrangement is not to be limiting. For example, in some embodiments, the biasing elements of the overspeed devices may be fixed at the first end (e.g., first end 346) and the centrifugal force and radial movement of the detectable element may pull or stretch the biasing element in the event of an overspeed condition. Further, in some embodiments, the biasing element may not be mechanical in nature (e.g., a spring), but may be a fluid contained within the track (e.g., such as a tube) with the fluid having sufficient viscosity to prevent movement of the detectable element except during overspeed conditions. These are merely examples of such overspeed devices, and various other configurations and assemblies are possible without departing from the scope of the present disclosure.

[0042] Further, although described above as triggering a safety operation, such as application of brakes, various other actions may be taken when a detection is made. For example, in some embodiments, when the switch of the system is actuated, a signal or notification can be sent to a maintenance system to trigger inspection and/or repair on the elevator system.

[0043] Moreover, although illustrated as circular body, the detectable element may have other shapes or configurations. For example in some embodiments, the detectable element may be a cylinder or other shape that is moveable within or along a track. Thus, in some embodiments, a piston-type arrangement may be used in place of the ball-spring arrangement illustratively shown. Various other arrangements are possible without departing from the scope of the present disclosure.

[0044] Furthermore, although shown and described above with first and second overspeed devices, with the two overspeed devices diametrically opposite each other, such arrangement is not to be limiting. As noted, the second overspeed device is provided to enable a balanced rotation of the roller. Accordingly, any balanced roller arrangement may be used without departing from the scope of the present disclosure. For example, in one non-limiting embodiment, three separate overspeed devices may be arranged within a roller, with the three overspeed devices arranged at 120° orientations relative to each other about the roller. In another embodiment, four overspeed devices may be arranged at 90° orientations relative to each other about the roller. Those of skill in the art will appreciate that any number of overspeed devices may be used, and in various orientations, without departing from the scope of the present disclosure.

[0045] Turning now to FIG. 4, a schematic illustration of an elevator system guiding device 470 in accordance with an embodiment of the present disclosure is shown. The elevator system guiding device 470 includes a first roller 472 and two second rollers 474, similar to that shown in FIG. 2B. The rollers 472, 474 are mounted to a mounting base 476, which in turn is mountable to a frame or other structure of an elevator car or a counterweight of an elevator system. At least one of the rollers 472, 474 (as shown one of the rollers 474) is configured as shown in FIGS. 3A-3B, including one or more overspeed devices therein. A detector 478 is mounted to the mounting base 476 and is operably connected to a safety system, such as described above. In some embodiments, each of the rollers 472, 474 can include one or more overspeed devices therein with associated detectors arranged relative thereto.

[0046] Advantageously, embodiments disclosed herein provide for improved overspeed detection systems for elevators. In accordance with embodiments of the present disclosure, the actual speed of an elevator car (or counterweight) can be monitored directly at the roller guide rather than requiring the installation of an overspeed governor, as typically used. If an overspeed condition is detected by systems of the present disclosure, a communication with a braking system (e.g., an electronic safety actuator) can be initiated to slow or stop the elevator car. Further, because of the electrical signal nature of embodiments of the present disclosure, a history of the elevator speed monitoring may be maintained to prevent unnecessary maintenance or service. Further, advantageously, because the overspeed detection of the present disclosure is based on rotation of the rollers, the systems of the present disclosure can be used in both up and down directions of travel.

[0047] While the present disclosure has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the present disclosure is not limited to such disclosed embodiments. Rather, the present disclosure can be modified to incorporate any number of variations, alterations, substitutions, combinations, sub-combinations, or equivalent arrangements not heretofore described, but which are commensurate with the scope of the present disclosure. Additionally, while various embodiments of the present disclosure have been described, it is to be understood that aspects of the present disclosure may include only some of the described embodiments.

[0048] Accordingly, the present disclosure is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

Claims

1. An overspeed detection system for an elevator system, the overspeed detection system comprising:

   a roller guide frame including a mounting base;
   a first roller supported on the mounting base, the first roller having a first roller wheel configured to engage with and rotate along a guide rail when installed in an elevator system;
   a first overspeed device arranged within the first roller wheel, the first overspeed device having a detectable element; and
   a detector defining a detection zone and arranged to detect the detectable element within the detection zone when the first roller wheel rotates at or above a threshold rotational speed.

2. The overspeed detection system of claim 1, wherein the first overspeed device comprises a track within the first roller wheel with the detectable element moveable within the track.

3. The overspeed detection system of any preceding claim, wherein the first overspeed device comprises a biasing element arranged to urge the detectable element away from the detection zone when the first roller wheel rotates at rotational speed below the threshold rotational speed.

4. The overspeed detection system of claim 3, wherein the biasing element is a spring.

5. The overspeed detection system of any of claims 3-4, wherein the detectable element is formed of a first material and the biasing element is formed of a second material that is different from the first material.

6. The overspeed detection system of any preceding claim, wherein the detectable element is a steel ball.

7. The overspeed detection system of any preceding claim, further comprising a switch operably connected to the detector such that when the detector detects the presence of the detectable element, the switch is actuated.

8. The overspeed detection system of any preceding claim, further comprising at least one additional overspeed device arranged within the first roller wheel and arranged to balance the first roller wheel during rotation.

9. The overspeed detection system of claim 8, wherein the at least one additional overspeed device is arrange diametrically opposite the first overspeed device.

10. The overspeed detection system of any of claims 8-9, wherein the at least one additional overspeed device comprises a detectable element and a biasing element.

11. An elevator system guiding device including the overspeed detection system of any of the preceding claims.

12. The elevator system guiding device of claim 11, wherein the elevator system guiding device is a guiding device of an elevator car or a counterweight.

13. An elevator system comprising:

an elevator shaft having a plurality of landings;
an elevator car movable within the elevator shaft along a car guide rail;
a counterweight movable within the elevator shaft along a counterweight guide rail; and
the overspeed detection system of any of the preceding claims arranged to detect an overspeed of at least one of the elevator car and the counterweight.

14. The elevator system of claim 13, wherein when the first roller wheel is detected rotating at or above the threshold rotational speed, a brake is applied to slow movement of the elevator car or the counterweight.

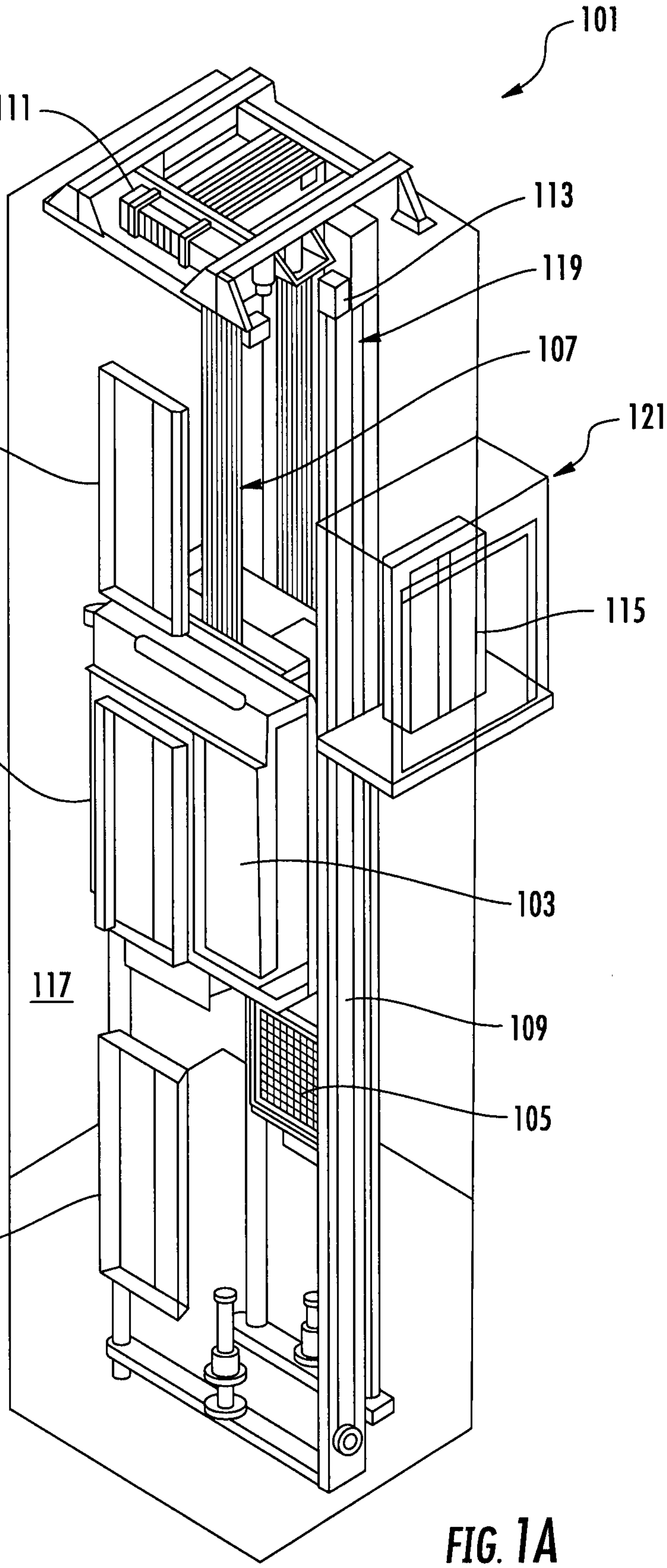

FIG. 1A

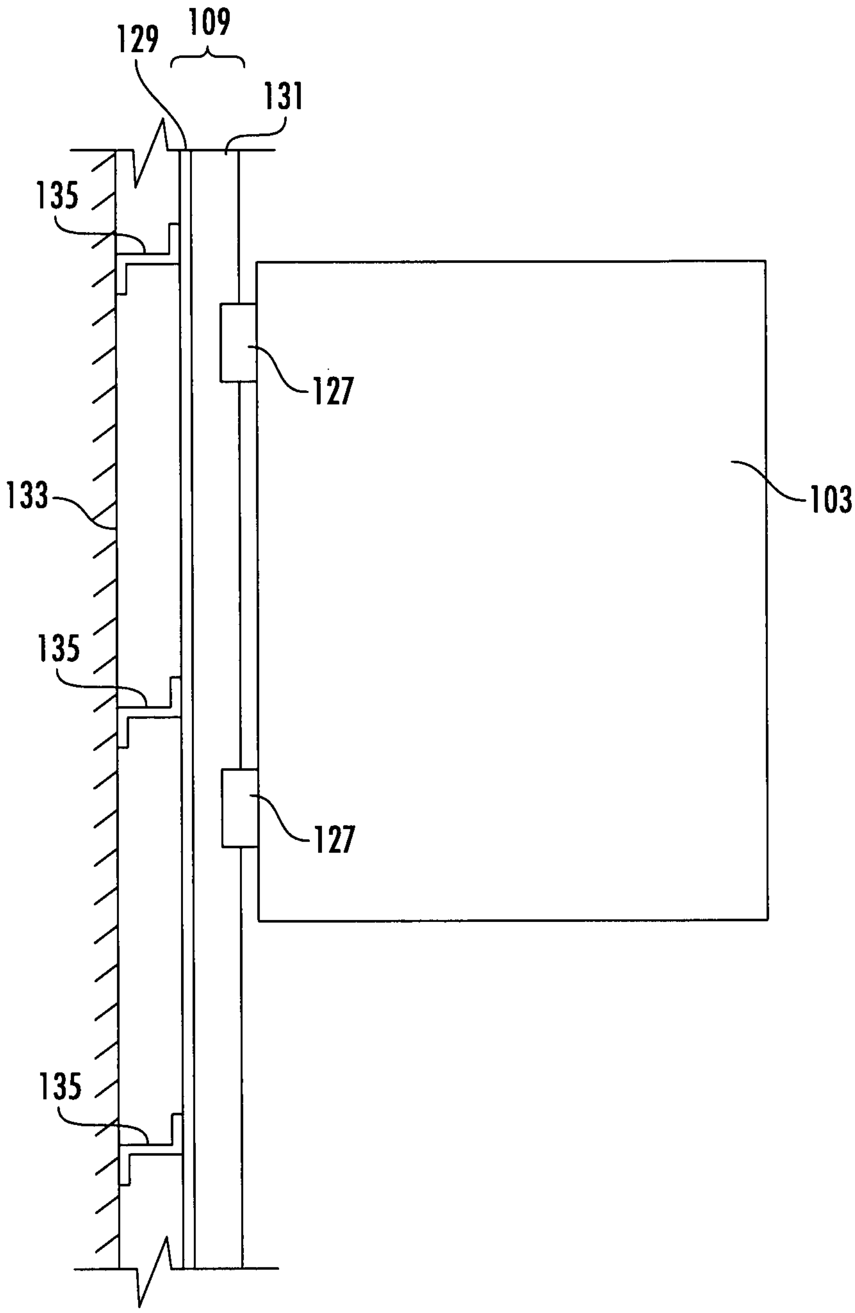

FIG. 1B

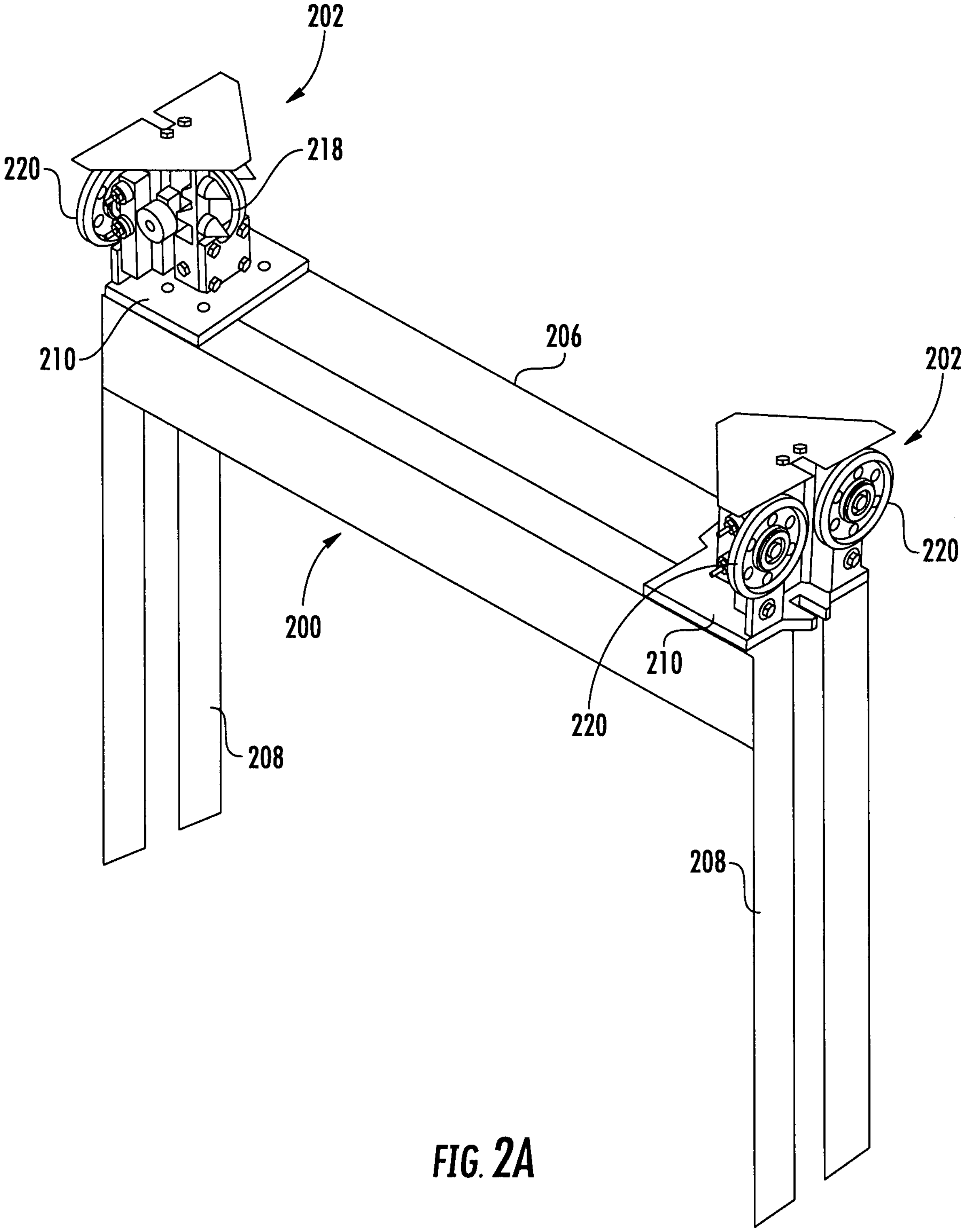

FIG. 2A

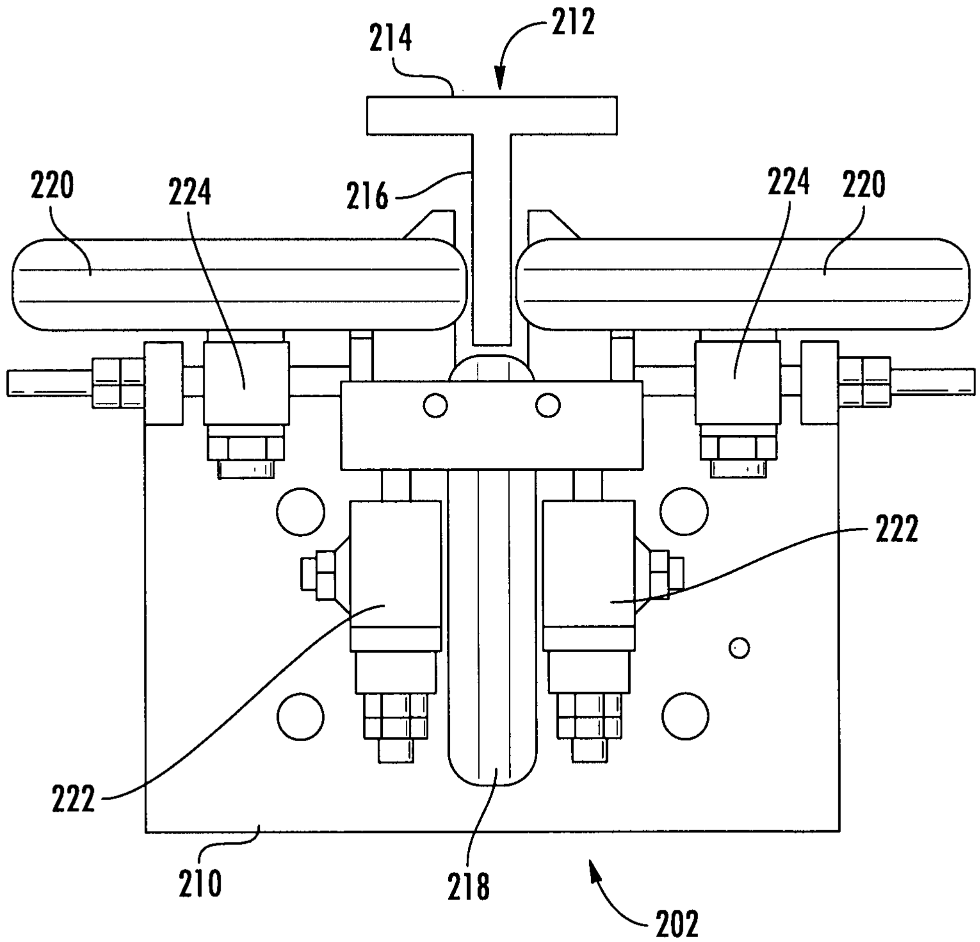

FIG. 2B

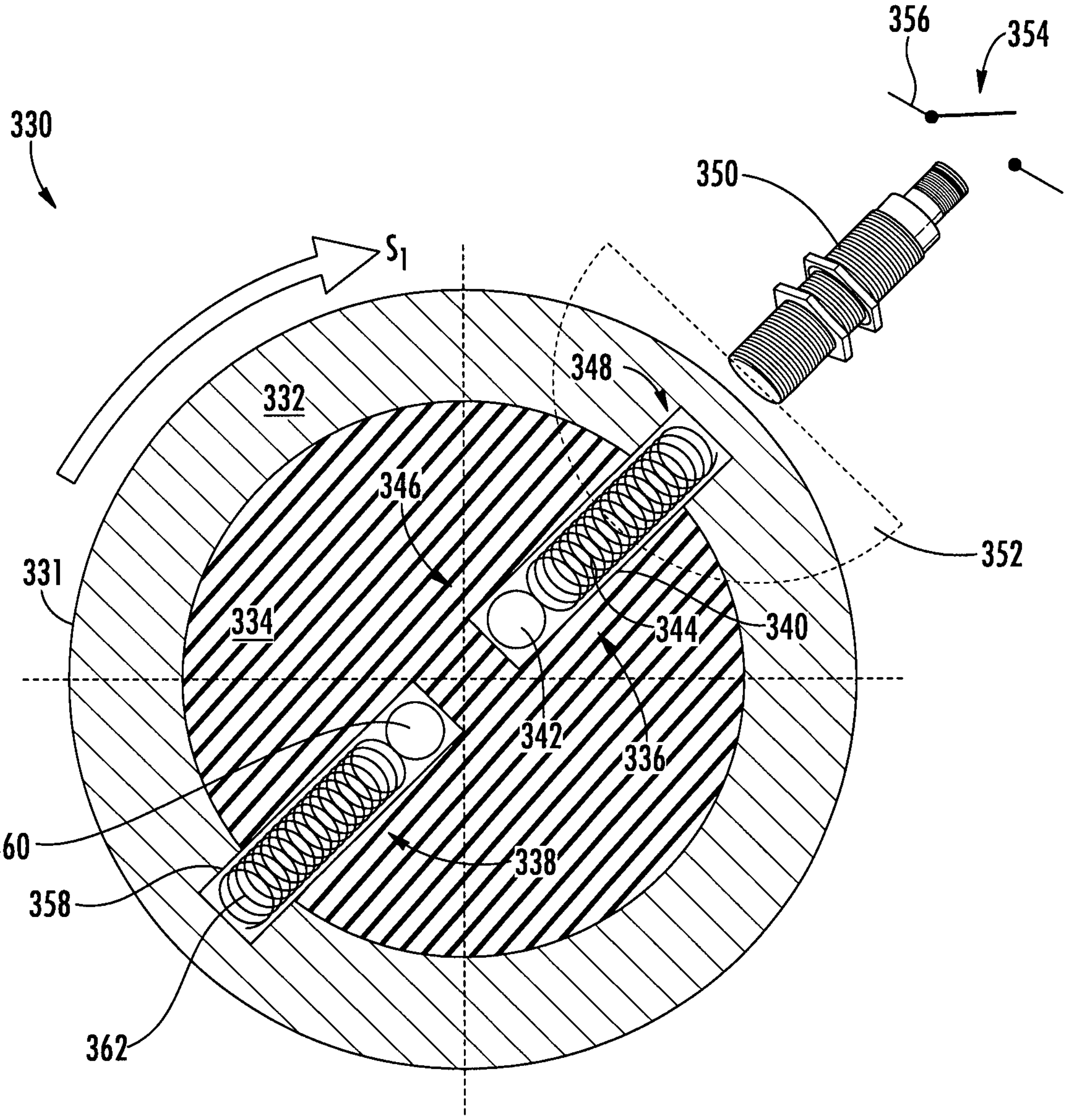
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FIG. 3A

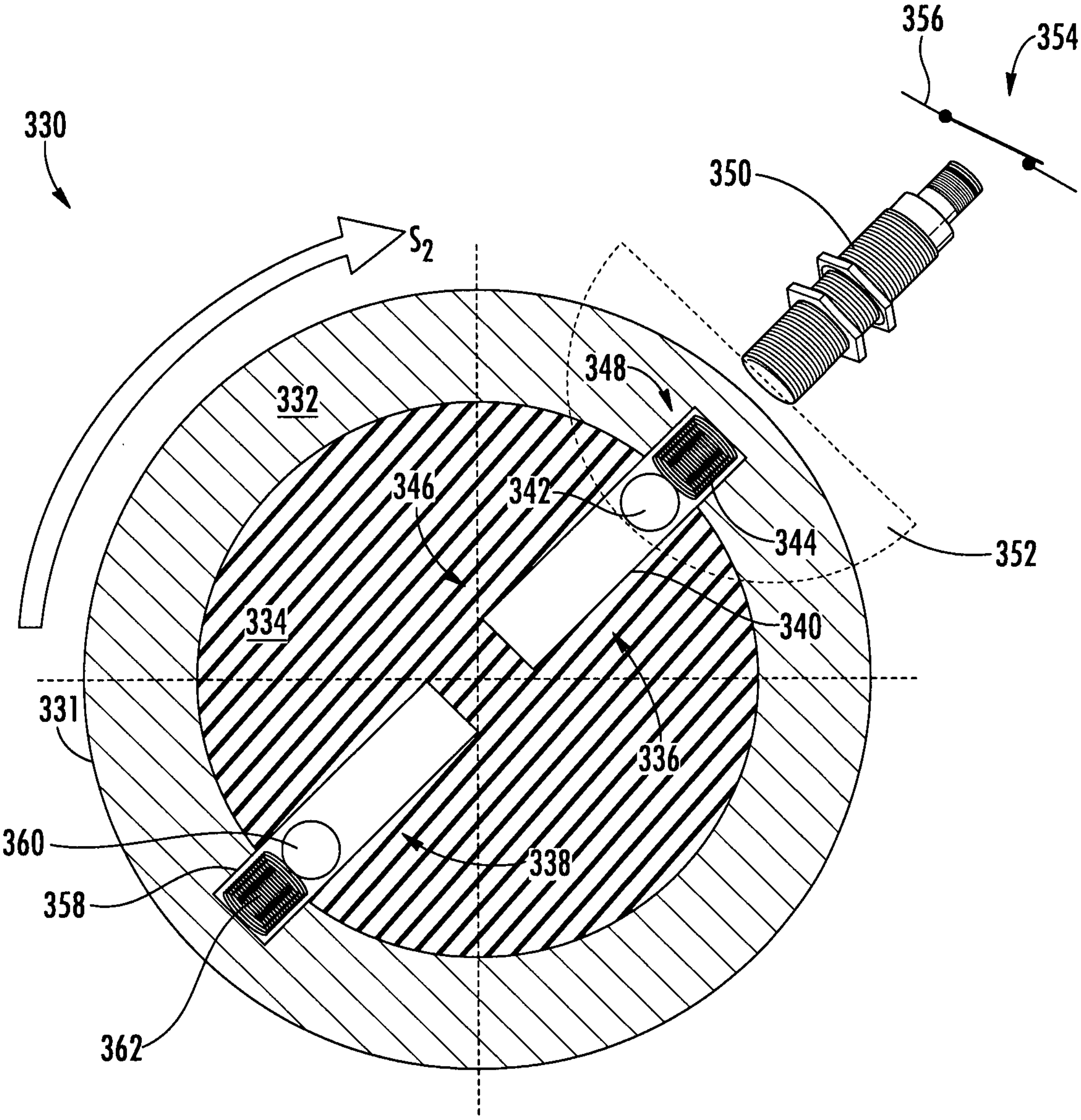
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FIG. 3B

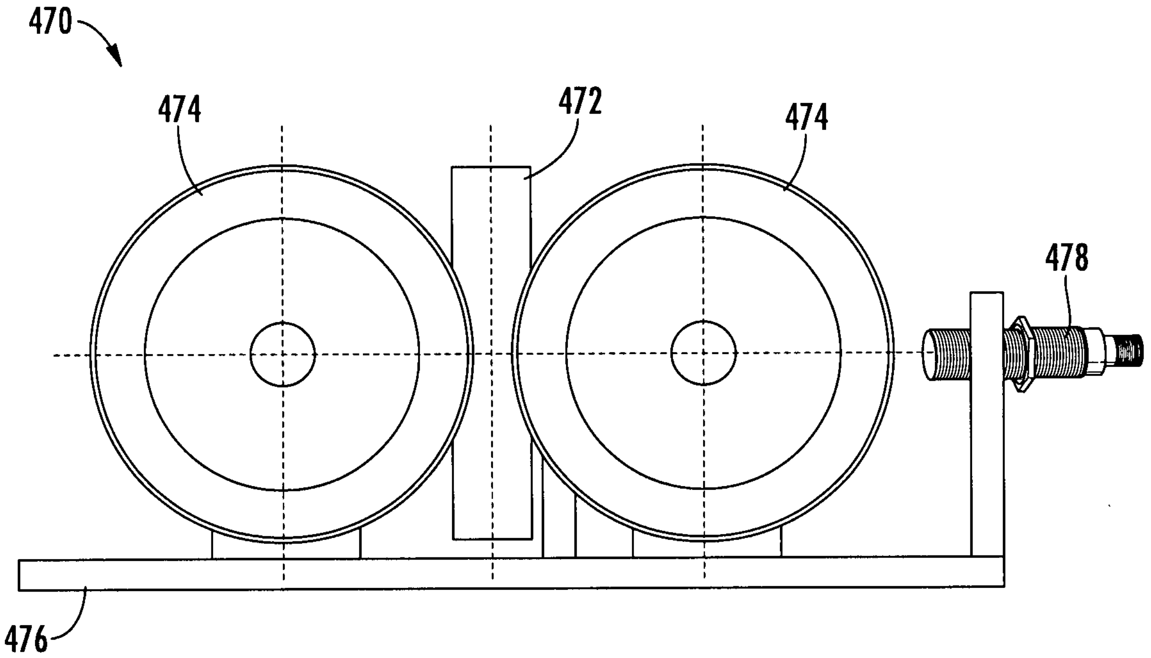

FIG. 4

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 18 30 5463

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	US 4 662 481 A (MORRIS KIM E [US] ET AL) 5 May 1987 (1987-05-05) * abstract; figure 1 * * column 2, line 16 - line 56 *	1-14	INV. B66B5/04
X	EP 1 908 721 A1 (ORONA S COOP [ES]) 9 April 2008 (2008-04-09) * abstract; figures 3a,3b,5a,5b,6a-6d *	1-14	
X	EP 2 020 397 A1 (THYSSENKRUPP ELEVATOR MFG SPAI [ES]) 4 February 2009 (2009-02-04) * abstract; figures 1,2,5a *	1-14	
X	US 5 052 523 A (ERICSON RICHARD J [US]) 1 October 1991 (1991-10-01) * abstract; figures 2,3 *	1-14	
A	US 764 038 A (CARPENTER MASON P [US]) 5 July 1904 (1904-07-05) * figure 4 *	1-14	TECHNICAL FIELDS SEARCHED (IPC) B66B

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	7 November 2018	Nelis, Yves

CATEGORY OF CITED DOCUMENTS

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