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(54) **ANTI-DERAILMENT SYSTEMS FOR SLIDING DOORS**

(57) Sliding door systems having a sliding door having a structural panel, a sill having a guide channel, wherein at least a portion of the structural panel is positioned within and movable through the guide channel, and an anti-derailment system. The anti-derailment system includes a panel extension extending from the structural panel, the panel extension located within the guide channel and a stop fixedly attached to the sill and located within the guide channel, wherein when the sliding door is in a closed position the panel extension is positioned proximate to the stop.

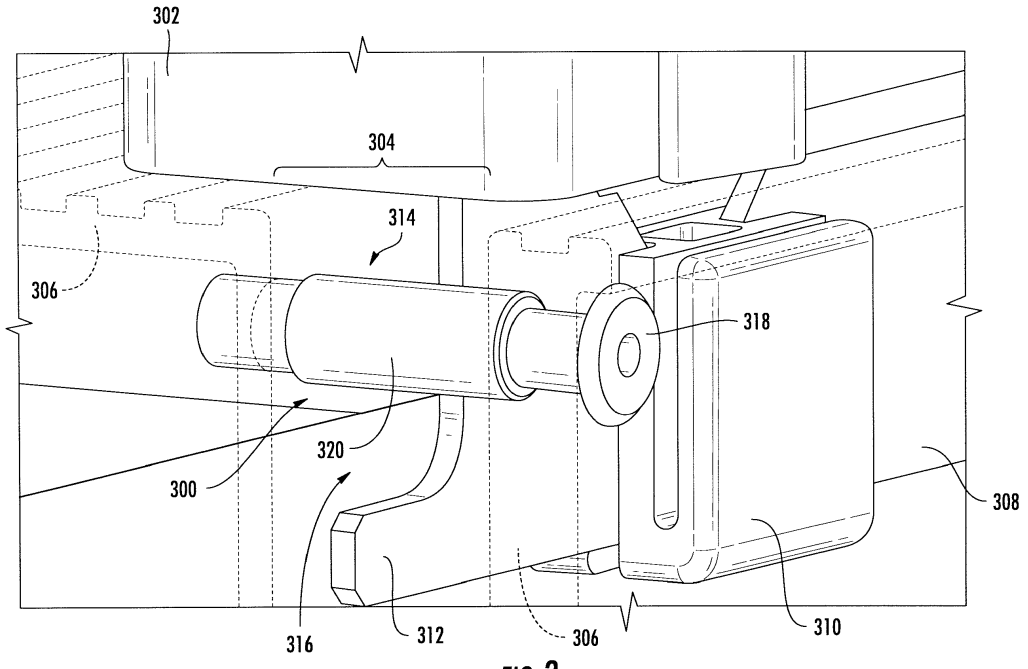

FIG. 3

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Description

BACKGROUND

[0001] The subject matter disclosed herein generally relates to sliding doors and, more particularly, to anti-derailment systems for sliding doors, and in some embodiments, elevator system sliding doors.

[0002] Elevator systems include sliding doors, both of the elevator car and at the landings. Such doors must be structurally sound and securable to prevent unauthorized access to an elevator shaft of the elevator system. Locks and locking mechanisms are typically employed to secure the sliding landing doors of an elevator system to prevent unauthorized opening of the sliding doors. However, the sliding doors must also be designed to prevent forced opening, such as by impact to the doors. Accordingly, in typical systems, the landing doors (and elevator car doors) can be manufactured with stiffeners or other structural components that provide additional strength to the sliding doors. Such strength prevents impacts from pushing the sliding doors inward, and potentially having a portion of the landing door "jump" from a track through which the sliding door is guided. The stiffeners will add additional costs, weight, and installation considerations, and thus improved sliding doors may be advantageous.

SUMMARY

[0003] According to some embodiments, sliding door systems are provided. The sliding door systems include, a sliding door having a structural panel, a sill having a guide channel, wherein at least a portion of the structural panel is positioned within and movable through the guide channel, and an anti-derailment system. The anti-derailment system includes a panel extension extending from the structural panel, the panel extension located within the guide channel and a stop fixedly attached to the sill and located within the guide channel, wherein when the sliding door is in a closed position the panel extension is positioned proximate to the stop.

[0004] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include that the stop is integrally formed with the sill.

[0005] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include that the stop is fixedly attached to the sill by a fastener.

[0006] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include that the stop further comprises a sleeve, wherein the sleeve fits within the guide channel and the fastener passes through the sleeve to fixedly hold the sleeve within the guide channel.

[0007] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include that the panel extension comprises an extension contact surface, wherein, when the sliding door is subject to an impact, the extension contact surface will contact the stop to prevent the structural panel from leaving the guide channel.

[0008] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include a guide shoe installed on the structural panel and arranged to guide the structural panel within the guide channel.

[0009] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include that the sliding door is a center closing sliding door, wherein the stop is positioned in a center of the sill.

[0010] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include that the sliding door is a sliding door of an elevator system

[0011] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include that the sliding door is an elevator landing door of the elevator system.

[0012] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include that the sliding door is an elevator car door of the elevator system.

[0013] In addition to one or more of the features described above, or as an alternative, further embodiments of the sliding door systems may include that the sliding door is a sliding door of a vehicle.

[0014] 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.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] 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. 1 is a schematic illustration of an elevator system that may employ various embodiments of the present disclosure;

FIG. 2 is a schematic illustration of a landing floor of an elevator system that may employ various embodiments of the present disclosure;

FIG. 3 is a schematic illustration of an anti-derailment

system in accordance with an embodiment of the present disclosure;

FIG. 4A is a schematic illustration of a sliding door having an anti-derailment system in accordance with an embodiment of the present disclosure;

FIG. 4B is an enlarged illustration of the anti-derailment system of FIG. 4A; and

FIG. 5 is a schematic, exploded illustration of an anti-derailment system in accordance with an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0016] FIG. 1 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 an elevator 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.

[0017] The roping 107 engages the machine 111, which, in this illustrative embodiment, is part of an overhead structure of the elevator system 101, although other arrangements are possible without departing from the scope of the present disclosure. 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.

[0018] The elevator controller 115 is located, as shown in the illustrative arrangement, 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. In other embodiments the controller 115 can be located in other locations, including, but not limited to, fixed to a landing or landing door or located in a cabinet at a landing. The elevator controller 115 may provide drive signals to the machine 111 to control the acceleration, deceleration, leveling, stopping, etc. of the elevator car 103. The elevator 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 elevator controller 115. Although shown in a controller room 121, those of skill in the art will appreciate that the elevator controller 115 can be located and/or configured in other locations or positions within the elevator system 101.

[0019] 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. 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. 1 is merely a non-limiting example presented for illustrative and explanatory purposes.

[0020] FIG. 2 is a schematic illustration of an elevator system 201 that may incorporate embodiments disclosed herein. As shown in FIG. 2, an elevator car 203 is located at a landing 225. The elevator car 203 may be called to the landing 225 by a passenger or mechanic 227 that desires to travel to another floor within a building or perform maintenance on a portion of the elevator system 201. A door lock can be provided in a landing door lintel 229 of the elevator system 201 (which may be located at one or more landings 225). The door lock in the landing door lintel 229 can be used to securely lock a landing door 231 to prevent unauthorized access to an elevator shaft. The landing door 231 is arranged to slide open and close along a landing door sill 233. The landing door sill 233 includes a guide, groove, or similar structure that is arranged to receive part of the landing door 231 to guide operation of the landing door 231.

[0021] In addition to being locked, landing doors of elevator systems are designed to withstand impacts to prevent forced entry or opening of the elevator landing doors, and thus prevent improper access to an elevator shaft. Thus, impact/shock resistance is provided for elevator landing doors to provide safety to passengers and prevent falls into the elevator shafts. To achieve this, the landing doors are arranged to remain in place and act as a barrier when the landing doors are closed. Typically, landing doors are reinforced with additional or heavy structural paneling that provides stiffness and strength to withstand impacts. For example, landing doors are typically made from relatively thin sheet metal thickness (e.g., 1.5 mm). Due to the thin metal of such landing doors, the panels typically require stiffeners or other structural reinforcement elements to withstand shocks and/or impacts.

[0022] It may be advantageous to provide stiff or safe elevator doors while minimizing costs, weight, and installation time by reducing the weight and components of elevator landing doors, while maintaining secure and stiff structural landing doors. Accordingly, embodiments provided herein are directed to improving the impact resistance of landing door panels, while decreasing the

number of stiffeners and/or enabling relatively thin (and light) landing door panels. For example, a stop (e.g., a brace, sleeve, etc.) located in the sill of the landing door system can be provided that enables increased strength or resistance to an elevator landing door at the time of an impact or shock.

[0023] For example, turning now to FIG. 3, a schematic illustration of an anti-derailment system 300 in accordance with an embodiment of the present disclosure is shown. The anti-derailment system 300 is installed with or as part of a sliding door 302, such as an elevator landing door or elevator car door, which slides during operation. The sliding door 302 is arranged to be guided within a guide channel 304 of a sill 306 (e.g., a sill groove or sill channel). The sliding door 302 includes a structural panel 308. The structural panel 308 provides stiffness and structure to the sliding door 302. In some embodiments, the structural panel 308 can operate as a frame for mounting a shell or other feature to provide aesthetic to the sliding door 302.

[0024] The structural panel 308 extends into the guide channel 304 to ensure the sliding door 302 is guided along the sill 306 during operation. As shown, a guide shoe 310 is mounted to or part of the structural panel 308 and is arranged to fit within and guide the structural panel 308 and thus the sliding door 302 along the guide channel 304.

[0025] To provide support, rather than adding additional supports or structural stiffeners, the structural panel 308 is configured with a panel extension 312 that forms part of the anti-derailment system 300. The anti-derailment system 300 further includes a stop 314 arranged within the sill 306 that is configured to interact with the panel extension 312 during an impact or shock to the structural panel 308 of the sliding door 302. The panel extension 312 is a part of the structural panel 308 that moves within the guide channel 304 and engages or contacts the stop 314 when the sliding door 302 is impacted to thus prevent the structural panel 308 from being forced out of the guide channel 304 (i.e., it prevents the structural panel 308 from "jumping" out of the guide channel 304). The panel extension 312 defines a stop gap 316 that enables to the panel extension 312 to move into position relative to the stop 314 when the sliding door 302 is closed.

[0026] The stop 314 is a structural element that is fixedly attached to or part of the sill 306. When the sliding door 302 is in the closed position, the panel extension 312 extends adjacent to and below the stop 314 which is positioned within the stop gap 316, as shown in FIG. 3. As shown in this embodiment, the stop 314 is formed of a fastener 318 and a sleeve 320. The sleeve 320 is arranged to fit within the guide channel 304 and the fastener 318 secures the sleeve 320 to the sill 306.

[0027] When the sliding door 302 is closed, during an impact to the door, the anti-derailment system 300 acts as a latch for the sliding door 302 (and specifically for the structural panel 308) to prevent the sliding door from lifting out of the guide channel 304 and over the sill 306.

[0028] Turning now to FIGS. 4A-4B, schematic illustrations of a sliding door 402 having an anti-derailment system 400 in accordance with an embodiment of the present disclosure are shown. The sliding door 402, in some embodiments, without limitation, may be an elevator landing door or an elevator car door that slides between an open position and a closed position. However, those of skill in the art will appreciate that various other types of sliding doors can incorporate embodiments of the present disclosure (e.g., train or other vehicle doors, sliding security doors, etc.). The sliding door 402 includes a structural panel 408 that forms a structural element of the sliding door 402, with a portion extending from an end thereof. The structural panel 408 includes and defines a portion of the anti-derailment system 400.

[0029] That is, as shown, the structural panel 408 includes a panel extension 412 that defines a stop gap 416 at a side, edge, or end of the structural panel 408. The structural panel 408 is configured to fit within and slide within a guide channel, as described above. When the sliding door 402 is in a closed position, a stop (not shown) is positioned within the stop gap 416, such as shown in FIG. 3. The stop gap 416 is defined, in part, by an extension contact surface 422. The extension contact surface 422 is a portion of the panel extension 412 that will contact a stop if the sliding door 402 is impacted and urged or forced in an upward or outward direction.

[0030] Also shown in FIGS. 4A-4B, the structural panel 408 can include one or more guide shoe apertures 424. The guide shoe apertures 424 are arranged to receive a guide shoe (not shown) to enable proper fit and movement within a guide channel, as described above.

[0031] Turning now to FIG. 5, a schematic illustration of an anti-derailment system 500 in accordance with an embodiment of the present disclosure is shown. The anti-derailment system 500 is shown in partial exploded view, illustrating an installation into a sill 506 and part of a sliding door 502. The sliding door 502 is arranged to be guided within a guide channel 504 of the sill 506. The sliding door 502 includes a structural panel 508. At least a portion of the structural panel 508 extends into the guide channel 504 to ensure the sliding door 502 maintains proper operation along the sill 506. As shown, a guide shoe 510 is mounted to or part of the structural panel 508 and is arranged to fit within and guide the structural panel 508 and thus the sliding door 502 along the guide channel 504.

[0032] Similar to the embodiments described above, the structural panel 508 is configured with a panel extension 512 that forms part of the anti-derailment system 500 and the sill 506 includes a stop 514. The panel extension 512 is a part of the structural panel 508 that moves within the guide channel 504 and engages or contacts the stop 514 when the sliding door 502 is impacted to thus prevent the structural panel 508 from being forced out of the guide channel 504. The panel extension 512 defines a stop gap 516 that enables to the panel exten-

sion 512 to move into position relative to the stop 514 when the sliding door 502 is closed.

[0033] In this embodiment, the stop 514 is a structural element that is fixedly attached to the sill 506. When the sliding door 502 is in the closed position, the panel extension 512 extends adjacent to and below the stop 514 which is positioned within the stop gap 516. As shown in this embodiment, the stop 514 is formed of a fastener 518 and a sleeve 520. The sleeve 520 is arranged to fit within the guide channel 504 and the fastener 518 secures the sleeve 520 to the sill 506. Although shown in FIG. 5 with the stop 514 being a separately installed component, in some embodiments, the stop 514 can be integrally formed with the sill 506. Such integral formation can include, but is not limited to, casting, welding, or other permanent fixation method or mechanism, as will be appreciated by those of skill in the art. Further, in some embodiments, the stop can be formed of a fastener only, such as a bolt, pin, or screw, and the sleeve can be omitted.

[0034] The structural panel extension of embodiments of the present disclosure are located at "ends" of the structural panels such that the extension is positioned relative to a stop when the sliding door is in a closed position. Thus, although the stops may typically be located adjacent a door frame (e.g., a side of a doorway), in some embodiments, one or more stops can be located within a guide channel of a sill. Such embodiments may be employed for center-opening sliding doors, e.g., two doors slide from opposing sides toward each other, and in the closed position the ends and thus the panel extensions are located in the center of the doorway.

[0035] Advantageously, embodiments provided herein enable sliding door anti-derailment systems. The anti-derailment systems enable decreasing a number of (or eliminating) additional stiffener that may typically be installed with a sliding door to prevent derailment of the sliding door during an impact. Further, embodiments provided herein can enable easy installation and inspection, as the components are external to the sliding doors (as compared to being stiffeners installed within a door panel).

[0036] Although shown and described specifically with respect to elevator doors, those of skill in the art that embodiments of the present disclosure are not so limited, and the elevator arrangement is provided merely for example only. In some arrangements, the anti-derailment systems of the present disclosure can be incorporated in to any type of sliding door that may require additional structural rigidity or strength, particularly to withstand impacts. Such sliding doors include, but are not limited to, public transportation sliding doors, such as on trains, subways, buses, or other sliding doors of vehicles, etc.

[0037] As used herein, the use of the terms "a," "an," "the," and similar references in the context of description (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or specifically contradicted by context. The modifier "about" used in connection with a quantity is inclusive of the stated value and has the meaning dictated by the context (e.g., it includes the degree of error associated with measurement of the particular quantity).

[0038] 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 spirit and 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.

[0039] 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. A sliding door system comprising:

   a sliding door having a structural panel;
   a sill having a guide channel, wherein at least a portion of the structural panel is positioned within and movable through the guide channel; and
   an anti-derailment system comprising:

   a panel extension extending from the structural panel, the panel extension located within the guide channel; and
   a stop fixedly attached to the sill and located within the guide channel, wherein when the sliding door is in a closed position the panel extension is positioned proximate to the stop.

2. The sliding door system of claim 1, wherein the stop is integrally formed with the sill.

3. The sliding door system of claim 1, wherein the stop is fixedly attached to the sill by a fastener.

4. The sliding door system of claim 3, wherein the stop further comprises a sleeve, wherein the sleeve fits within the guide channel and the fastener passes through the sleeve to fixedly hold the sleeve within the guide channel.

5. The sliding door system of any preceding claim, wherein the panel extension comprises an extension contact surface, wherein, when the sliding door is subject to an impact, the extension contact surface

will contact the stop to prevent the structural panel from leaving the guide channel.

6. The sliding door system of any preceding claim, further comprising a guide shoe installed on the structural panel and arranged to guide the structural panel within the guide channel.

7. The sliding door system of any preceding claim, wherein the sliding door is a center closing sliding door, wherein the stop is positioned in a center of the sill.

8. The sliding door system of any preceding claim, wherein the sliding door is a sliding door of an elevator system

9. The sliding door system of claim 8, wherein the sliding door is an elevator landing door of the elevator system.

10. The sliding door system of claim 8, wherein the sliding door is an elevator car door of the elevator system.

11. The sliding door system of any of claims 1-7, wherein the sliding door is a sliding door of a vehicle.

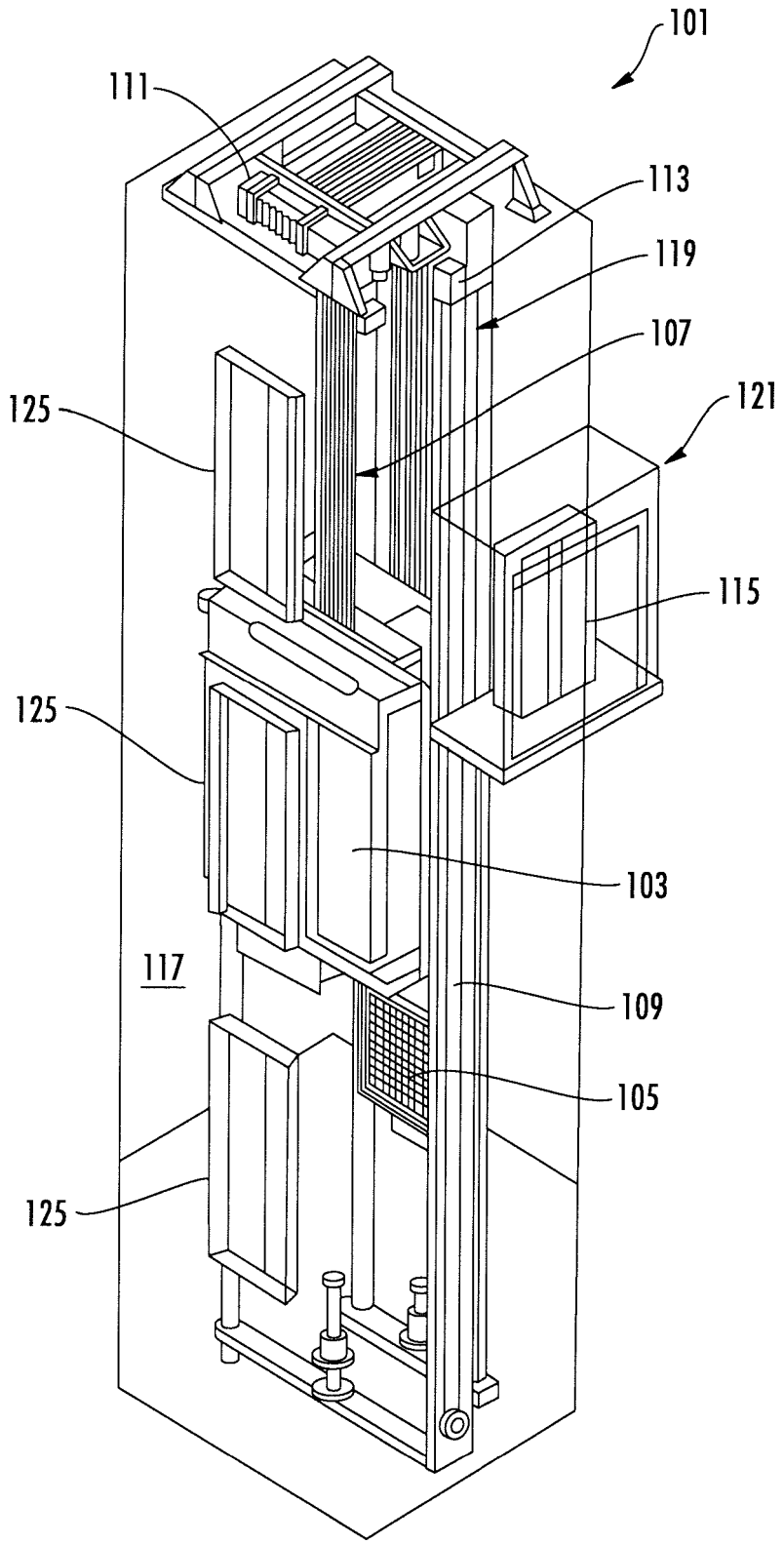

FIG. 1

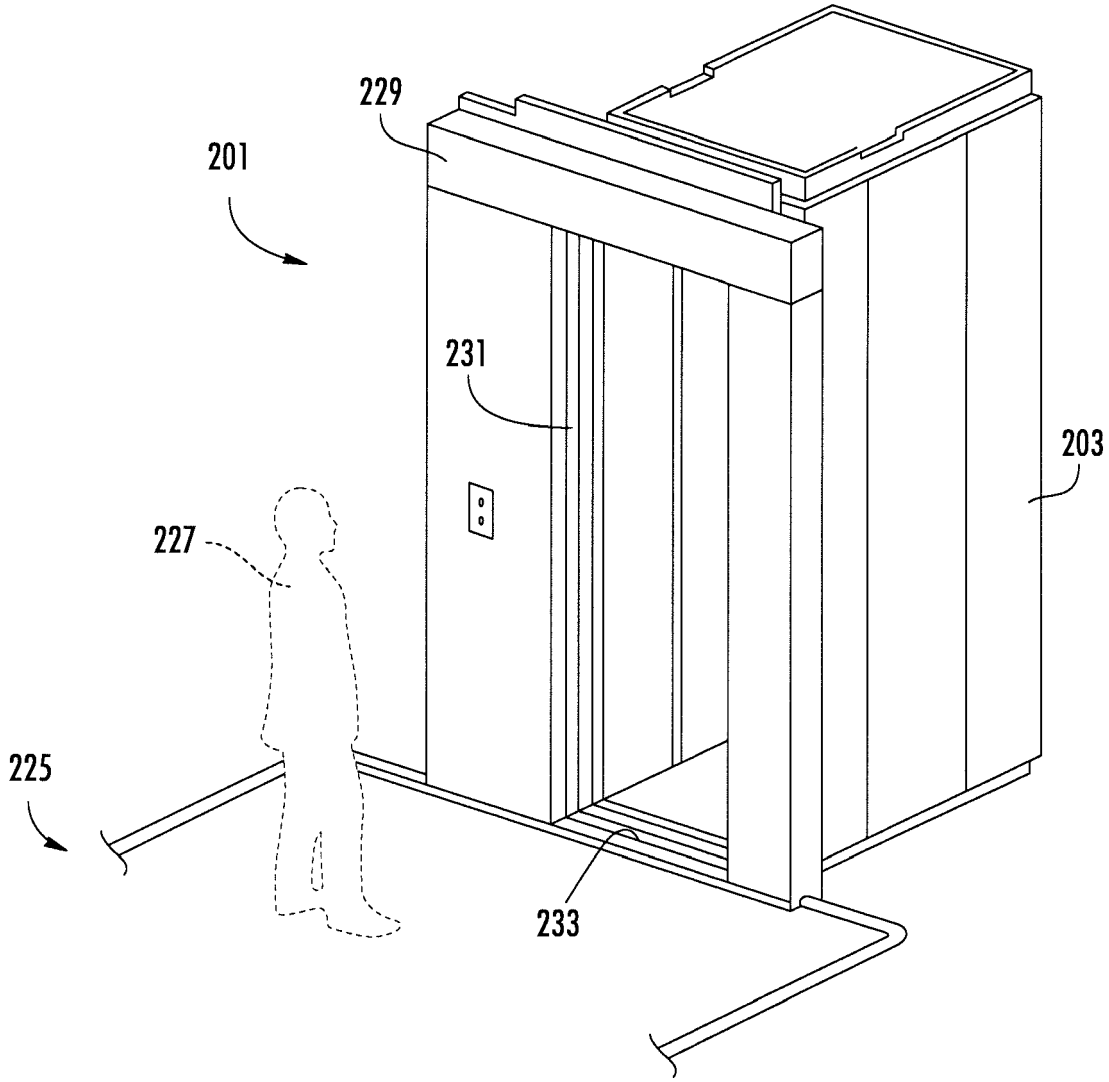

FIG. 2

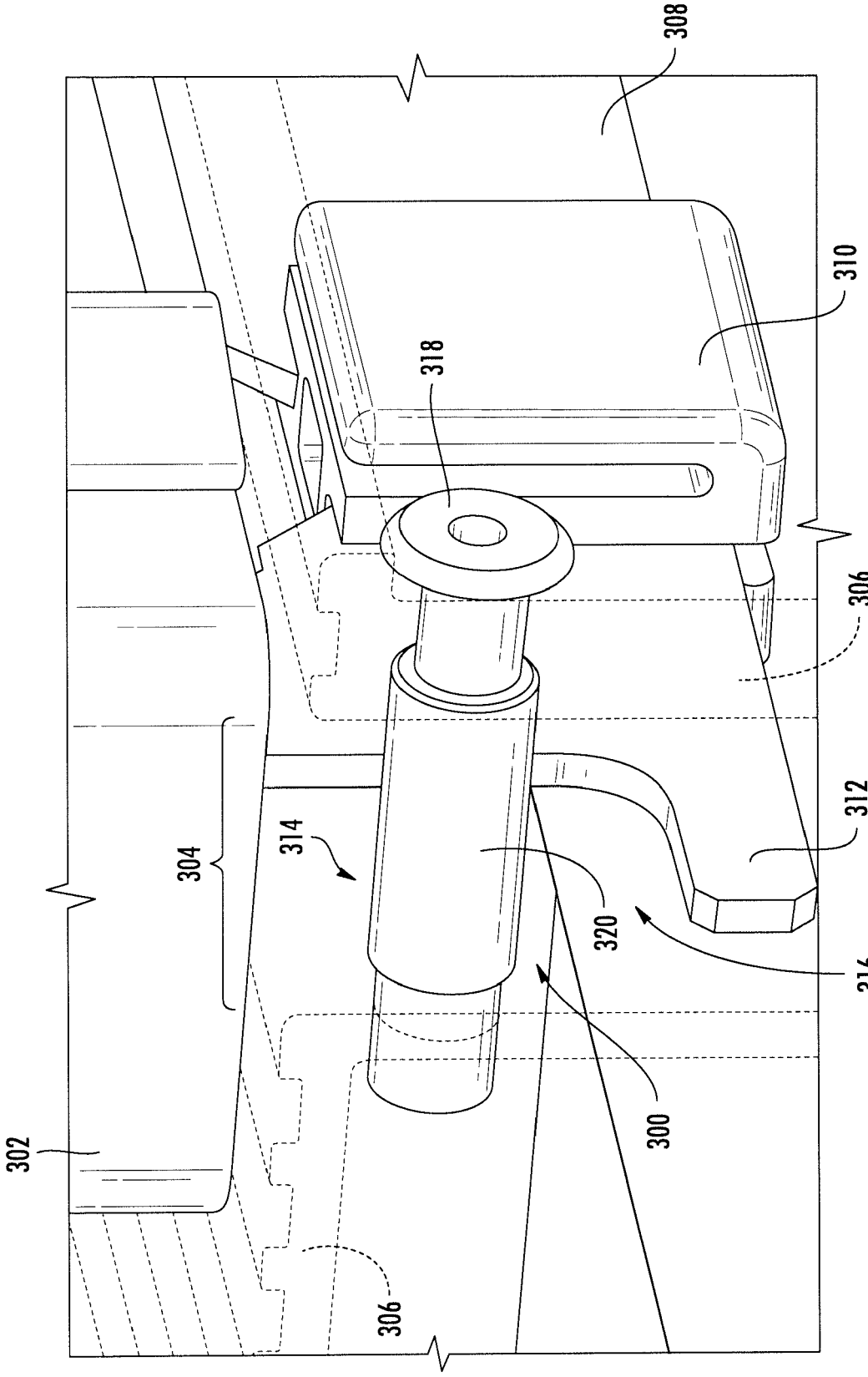

FIG. 3

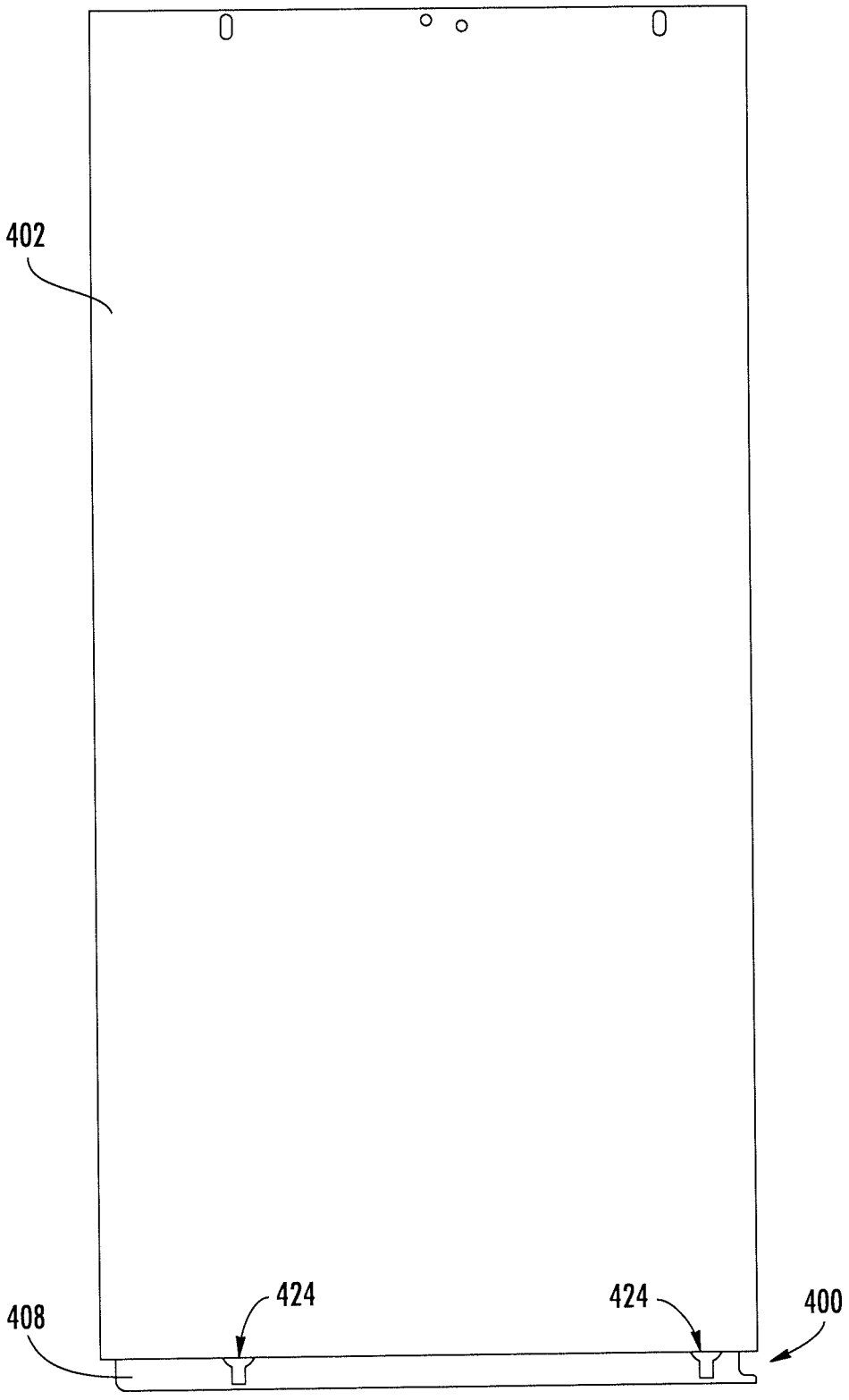

FIG. 4A

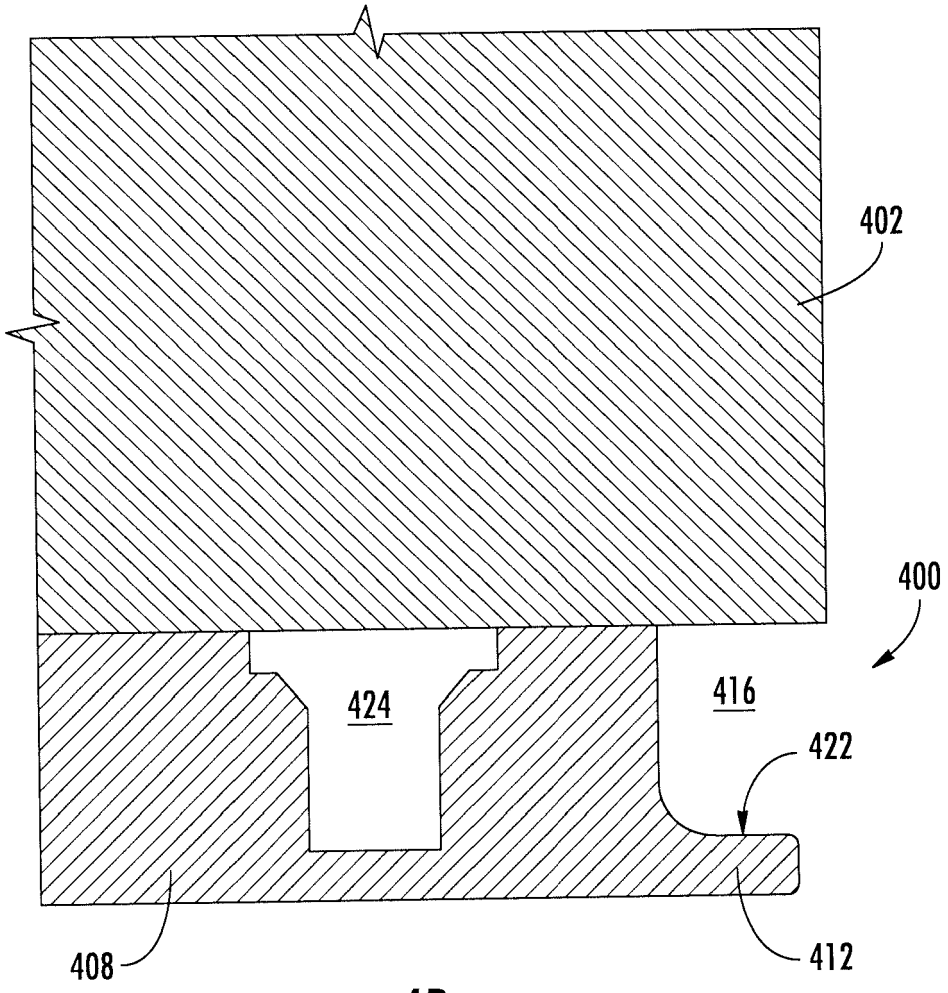

FIG. 4B

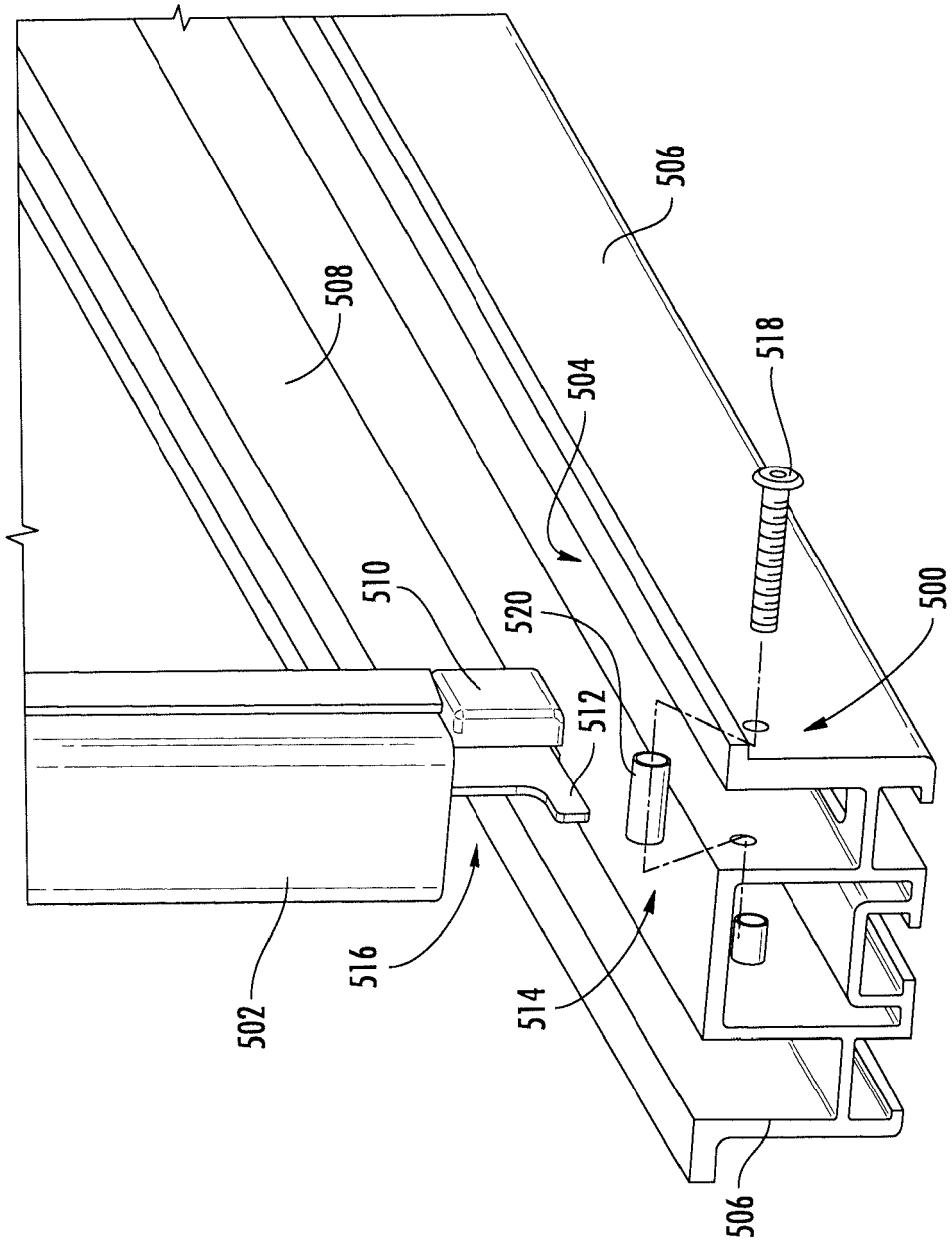

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 17 30 6592

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 May 2018	Nelis, Yves

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 30 6592

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