



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.03.2022 Bulletin 2022/09

(51) International Patent Classification (IPC):
E05B 77/04^(2014.01)

(21) Application number: **20193464.3**

(52) Cooperative Patent Classification (CPC):
E05B 77/04

(22) Date of filing: **28.08.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **TOYOTA JIDOSHA KABUSHIKI KAISHA**
TOYOTA-SHI, AICHI-KEN 471-8571 (JP)

(72) Inventor: **ANTONIOTTI, Mattia**
1140 BRUSSELS (BE)

(74) Representative: **Cabinet Beau de Loménie**
158, rue de l'Université
75340 Paris Cedex 07 (FR)

(54) **HANDLE SPACER AND SAFETY SYSTEM FOR A DOOR OF A VEHICLE**

(57) A spacer (20) for a door locking system (110) of a door (100) of a vehicle, the door locking system including a handle (120), a handle frame (140), and a door locking rod (180), and the spacer including a body (22) having a first end (24) and a second end (26), the body being configured to extend between the handle frame

and a glass lower frame (115) arranged within the door of the vehicle, and wherein, the second end of the body is capable of contacting the glass lower frame to maintain spacing between the handle frame and the glass lower frame when an impact is sustained by the door.

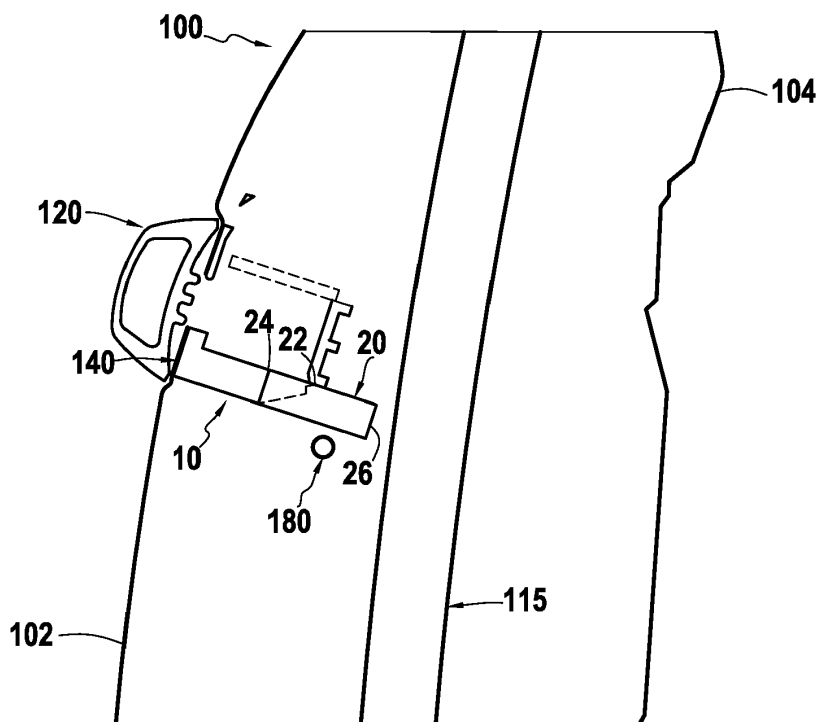


FIG.3

Description

FIELD

[0001] The present disclosure relates to the field of safety systems for vehicles. More specifically, the present disclosure relates to a safety system configured to prevent unintentional opening of a door of a vehicle when an impact is sustained by the door of the vehicle.

BACKGROUND

[0002] A door of a vehicle typically includes an outside handle configured to allow a user of the vehicle to open the door of the vehicle. Additionally, the door of the vehicle typically includes a door lock which is configured to keep the door of the vehicle closed until the user employs the outside handle to open the door of the vehicle. Between the outside handle and the door lock is a connection which is configured to transfer input from the outside handle and/or the user to the door lock, thereby allowing the door to be opened. The connection between the outside handle and the door lock is typically a physical connection or an electronic connection. For physical connections, a door locking rod may extend between the outside handle and the door lock. Upon an impact sustained by the door of the vehicle in a crash, an outer panel of the door of the vehicle may be deformed, which may displace the door locking rod and trap the door locking rod between the outer panel of the door and a surrounding part within the door of the vehicle. Displacing and trapping the door locking rod may cause unintentional opening of the door, thereby creating an unsafe condition.

[0003] Many vehicles may include a rotating counterweight attached to the door locking rod which is configured to prevent the outside handle from self-opening the door when an impact is sustained by the door of a vehicle. However, due to local panel deformations of the door, as well as many possible deformation modes (such as those caused by different heights of vehicles from the ground), predicting exact forces and acceleration that will locally influence the outside handle when an impact is sustained by a door is difficult. Therefore, the counterweight may not always function as expected. Additionally, even with use of the counterweight, the door locking rod may still be trapped between the outer panel of the door and a surrounding part, causing unintentional opening of the door when an impact is sustained by the door.

[0004] Currently available safety systems, such as that disclosed by German Patent Application No. DE102008011754 may include installing a heavy, metal part which is attached to the outer panel of the door of the vehicle and configured to only protect the outside handle when an impact is sustained by a door of a vehicle. Protecting only the outside handle does not effectively prevent the door locking rod from being trapped when an impact is sustained by the door of the vehicle. Additionally, using separate, heavy parts increases the weight

and manufacturing costs associated with implementing the safety system.

[0005] It is desirable to provide a lightweight, cost-efficient safety system configured to prevent a door locking rod of a door locking system from being trapped between an outer panel of a door of a vehicle and a surrounding part within the door of the vehicle, in order to prevent unintentional opening of the door of the vehicle when an impact is sustained by the door of the vehicle.

SUMMARY

[0006] According to aspects of the disclosure, a spacer for a door locking system of a door of a vehicle is presented, the door locking system includes a handle, a handle frame, and a door locking rod, and the spacer comprises a body having a first end and a second end, the body is configured to extend between the handle frame and a glass lower frame arranged within the door of the vehicle, and wherein, the second end of the body is capable of contacting the glass lower frame to maintain spacing between the handle frame and the glass lower frame when an impact is sustained by the door.

[0007] According to aspects of the disclosure, the body of the spacer is configured to extend directly from the handle frame of the door locking system.

[0008] According to aspects of the disclosure, the body of the spacer is configured to be integral to the handle frame of the door locking system.

[0009] According to aspects of the disclosure, the spacer is configured to overlap with the glass lower frame.

[0010] According to aspects of the disclosure, a safety system for a door of a vehicle is presented, the door of the vehicle includes an outer panel, an inner panel, and a glass lower frame configured to hold glass between the outer panel and the inner panel, and the safety system comprises a handle configured to allow a user to open the door of the vehicle, a handle frame configured to support the handle, at least a portion of the handle frame is arranged between the outer panel and inner panel of the door of the vehicle, a door lock configured to transition between a first position and a second position, a door locking rod configured to transition the door lock between the first position and the second position, the spacer according to any aspect described herein, and wherein, the spacer is capable of contacting the glass lower frame to maintain spacing between the outer panel of the door and the glass lower frame when an impact is sustained by the door.

[0011] According to aspects of the disclosure, the spacer is distanced from the outer panel of the door by the handle frame.

[0012] In the manner described and according to aspects illustrated herein, the safety system and the spacer provide a lightweight, cost-efficient safety system configured to prevent a door locking rod of a door locking system from being trapped between an outer panel of a door

of a vehicle and a surrounding part within the door of the vehicle, in order to prevent unintentional opening of the door of the vehicle when an impact is sustained by the door of the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Aspects of an embodiment will be described in reference to the drawings, where like numerals reflect like elements:

Figure 1 is a side perspective view of a door locking system according to aspects of the disclosure;
 Figure 2 is a side perspective view of a safety system according to aspects of the disclosure and a partial view of the door locking system of Figure 1;
 Figure 3 is a side cross-sectional view of the safety system of Figure 2 and a door locking rod of the door locking system of Figure 1, shown in a door of a vehicle;
 Figure 4 is a rear perspective view of the safety system of Figure 2;
 Figure 5 is a partial top cross-sectional view of the door locking system of Figure 1, shown without the safety system of Figure 2, illustrating the door locking rod of the door locking system of Figure 1 trapped between an outer panel of a door of a vehicle and a glass lower frame within the door of the vehicle when an impact is sustained by the door of the vehicle; and
 Figure 6 is a graphical representation of displacement of the door locking rod of the door locking system of Figure 1 when an impact is sustained by a door of a vehicle.

DETAILED DESCRIPTION

[0014] An embodiment of a safety (spacing) system and an outside handle spacer (referred to herein as a "spacer") according to aspects of the disclosure will now be described with reference to Figures 1-6. Like numerals represent like parts, and the safety system and the spacer will generally be referred to by the reference numerals 10 and 20, respectively. Although the safety system 10 and the spacer 20 are described with reference to specific examples, it should be understood that modifications and changes may be made to these examples without going beyond the general scope as defined by the claims. In particular, individual characteristics of the various embodiments shown and/or mentioned herein may be combined in additional embodiments. Consequently, the description and the drawings should be considered in a sense that is illustrative rather than restrictive. The Figures, which are not necessarily to scale, depict illustrative aspects and are not intended to limit the scope of the disclosure. The illustrative aspects depicted are intended only as exemplary.

[0015] The term "exemplary" is used in the sense of "example," rather than "ideal." While aspects of the dis-

closure are amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit aspects of the disclosure to the particular embodiment(s) described. On the contrary, the intention of this disclosure is to cover all modifications, equivalents, and alternatives falling within the scope of the disclosure.

[0016] Various materials, methods of construction and methods of fastening will be discussed in the context of the disclosed embodiment(s). Those skilled in the art will recognize known substitutes for the materials, construction methods, and fastening methods, all of which are contemplated as compatible with the disclosed embodiment(s) and are intended to be encompassed by the appended claims.

[0017] As used in this disclosure and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the content clearly dictates otherwise. As used in this disclosure and the appended claims, the term "or" is generally employed in its sense including "and/or" unless the content clearly dictates otherwise.

[0018] Throughout the description, including the claims, the terms "comprising a," "including a," and "having a" should be understood as being synonymous with "comprising one or more," "including one or more," and "having one or more" unless otherwise stated. In addition, any range set forth in the description, including the claims should be understood as including its end value(s) unless otherwise stated. Specific values for described elements should be understood to be within accepted manufacturing or industry tolerances known to one of skill in the art, and any use of the terms "substantially," "approximately," and "generally" should be understood to mean falling within such accepted tolerances.

[0019] When an element or feature is referred to herein as being "on," "engaged to," "connected to," or "coupled to" another element or feature, it may be directly on, engaged, connected, or coupled to the other element or feature, or intervening elements or features may be present. In contrast, when an element or feature is referred to as being "directly on," "directly engaged to," "directly connected to," or "directly coupled to" another element or feature, there may be no intervening elements or features present. Other words used to describe the relationship between elements or features should be interpreted in a like fashion (e.g., "between" versus "directly between," "adjacent" versus "directly adjacent," etc.).

[0020] Spatially relative terms, such as "top," "bottom," "middle," "inner," "outer," "beneath," "below," "lower," "above," "upper," and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the drawings. Spatially relative terms may be intended to encompass different orientations of a device in use or operation in addition to the orientation depicted in the drawings. For example, if the device in the drawings is turned over, elements described as "below" or "be-

neath" other elements or features would then be oriented "above" the other elements or features. Thus, the example term "below" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0021] Although the terms "first," "second," etc. may be used herein to describe various elements, components, regions, layers, sections, and/or parameters, these elements, components, regions, layers, sections, and/or parameters should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer, or section from another region, layer, or section. Thus, a first element, component, region, layer, or section discussed herein could be termed a second element, component, region, layer, or section without departing from the teachings of the present disclosure.

[0022] As shown in Figures 1-6, the safety system 10 and the spacer 20 may be configured to prevent unintentional opening of a door 100 of a vehicle (not shown) due to impact sustained by the door 100 of the vehicle. Referring to Figure 3, the door 100 of a vehicle includes an outer panel 102 and an inner panel 104. It is contemplated that the terms "outer" and "inner" as used herein may be understood with reference to an interior of a vehicle, such that the outer panel 102 is at and/or closer to an exterior (outside) of the vehicle and the inner panel 104 is at and/or closer to the interior (inside) of the vehicle. Additionally, the door 100 includes a window (not shown). As such, glass is arranged between the outer panel 102 and the inner panel 104 of the door 100. As shown in Figures 2-3, the glass is held and/or positioned within the door 100 by a glass lower frame (also referred to herein as a "support") 115. As such, the glass lower frame 115 is arranged between the outer panel 102 and the inner panel 104 of the door 100. It is contemplated that the term "lower" as used herein may be understood to mean a position at which the glass is supported, and/or a position at which the glass lower frame 115 is positioned with respect to the glass. As shown in Figures 2-3, the glass lower frame 115 extends substantially parallel to the outer panel 102 and the inner panel 104 of the door 100. The glass lower frame 115 may be configured to translate in an upward direction and a downward direction due to opening and closing of the window. It is contemplated the terms "upward" and "downward" may be understood with reference to a vehicle, such that the upward direction is toward a roof of the vehicle and the downward direction is toward a surface beneath the vehicle.

[0023] The door 100 is configured to move between an open condition and a closed condition. As shown in Figure 1, the door 100 includes a door locking system 110 configured to maintain the door 100 in the closed condition, and to allow a user to move the door 100 to the open condition. Referring to Figures 1-3 of the dis-

closed embodiment, the door locking system 110 includes an outside handle (referred to herein as a "handle") 120 configured to receive input from a user to move the door 100 to the open condition; an outside handle frame (referred to herein as a "handle frame") 140 configured to support the handle 120; a door lock 160 configured to transition from a locked state (first position) to an unlocked state (second position), in order to enable movement of the door 100 to the open condition, and from the unlocked state to the locked state, in order to maintain the door 100 in the closed condition; and a door locking rod 180 configured to transmit the input from the handle 120 to the door lock 160 to move the door 100 to the open condition. The door locking system 110 is configured to function between the outer panel 102 and the inner panel 104 of the door 100. The spacer 20 is configured to function in combination with the door locking system 110 as part of the safety system 10. Additionally or alternatively, it is contemplated that the spacer 20 is configured to be incorporated by the door locking system 110 as part of the safety system 10. Additionally or alternatively, it is contemplated that the safety system 10 may correspond to a combination of the handle frame 140 and the spacer 20 (see Figure 4). In this manner, the safety system 10 and the spacer 20 are configured to prevent the door 100 from opening unintentionally due to an impact sustained by the door 100.

[0024] As shown in Figures 1-3, the handle 120 may be positioned at an outer wall of the outer panel 102 of the door 100. In the disclosed embodiment, the handle 120 is connected to and/or supported by the handle frame 140. The handle frame 140 may be attached to and/or extend through the outer panel 102 of the door 100. Additionally or alternatively, the handle frame 140 may be attached to an inner wall of the outer panel 102 (see Figures 2-3). As shown in Figure 3, at least a portion of the handle frame 140 is positioned between the outer panel 102 and the inner panel of the door 100. The handle frame 140 may be constructed of a polymeric material. In the disclosed embodiment, the handle frame 140 is constructed of a plastic material. However, it is contemplated that a person having ordinary skill in the art that would appreciate that the handle frame 140 may be constructed of any other alternative material which may be compatible with the safety system 10 and/or the spacer 20. Additionally, it is contemplated that an alternative material may be compatible with the safety system 10 and/or the spacer 20 if the alternative material is durable, lightweight, and/or is capable of being formed integrally with the spacer 20. As shown in Figures 1-2, the handle 120 is connected to the door locking rod 180. Additionally or alternatively, the handle 120 may be connected to a counterweight, which is connected to the door locking rod 180, to prevent self-opening by the handle 120. Additionally, the door locking rod 180 is connected to the door lock 160. As such, the door locking rod 180 is configured to transmit input from the user to the door lock 160. In this manner, the handle 120 and the door locking rod 180 are

configured to transition the door lock 160 to the unlocked state to move the door 100 from the closed condition to the open condition.

[0025] The door lock 160 may be attached to the inner panel 104 of the door 100. Referring to Figures 1-3, the glass lower frame 115 extends between the door lock 160 and the door locking rod 180. As such, referring to Figure 3, the door locking rod 180 extends between the glass lower frame 115 and the outer panel 102 of the door 100. Additionally, the door locking rod 180 extends between the glass lower frame 115 and the handle frame 140. The door locking rod 180 extends downwardly beneath the spacer 20.

[0026] As shown in Figures 3-4, the spacer 20 is configured to extend between the glass lower frame 115 and the handle frame 140. As such, the spacer 20 extends between the glass lower frame 115 and the outer panel 102 of the door 100. In the disclosed embodiment, the spacer 20 is attached to the handle frame 140. As such, the spacer 20 is distanced from the outer panel 102 of the door 100 by the handle frame 140. In the disclosed embodiment, the spacer 20 is integrally formed with the handle frame 140, such that the spacer 20 and the handle frame 140 may be manufactured as one part. The spacer 20 is constructed of a rigid material, such that the spacer 20 may withstand force exerted on the spacer 20 when the outer panel 102 of the door 100 sustains an impact. In the disclosed embodiment, the spacer 20 is constructed of the same material as the handle frame 140. As such, the spacer 20 is constructed of a polymeric material. Preferably, the spacer 20 is constructed of a plastic material. However, it is contemplated that a person having ordinary skill in the art that would appreciate that the spacer 20 may be constructed of any other alternative material which may be compatible with the safety system 10 and/or the handle frame 140. Additionally, it is contemplated that an alternative material may be compatible with the safety system 10 and/or the handle frame 140 if the alternative material is durable, lightweight, and/or is capable of being formed integrally with the handle frame 140. Constructing the spacer 20 of a polymeric material, preferably a plastic material, allows the spacer 20 to be lightweight. Additionally, since the handle frame 140 is also constructed of a polymeric material, preferably a plastic material, the spacer 20 only adds a small increase in weight to the handle frame 140, thus making the safety system 10 lightweight. Additionally, manufacturing the handle frame 140 and the spacer 20 as one integral part, rather than separate components, allows for manufacture and/or addition of the spacer 20 to be cost-efficient. In this manner, manufacturing the handle frame 140 and the spacer 20 as one integral part, rather than separate components, allows for the safety system 10 to be lightweight and cost-efficient.

[0027] As shown in Figure 2-4, the spacer 20 includes a body 22 extending between a first end 24 and a second end 26. In the disclosed embodiment, the first end 24 of the body 22 of the spacer 20 is attached to and/or inte-

grally formed with the handle frame 140. Additionally, the second end 26 of the body 22 of the spacer 20 is positioned adjacent the glass lower frame 115. As such, the spacer 20 extends from the handle frame 140 toward the glass lower frame 115. In this manner, the spacer 20 is configured and/or positioned to overlap and/or align with the glass lower frame 115 (see Figure 4), so that the spacer 20 may contact the glass lower frame 115 when an impact is sustained by the door 100. Alternatively, it is contemplated that first end 24 of the body 22 of the spacer 20 may be attached to and/or integrally formed with the glass lower frame 115, such that the spacer 20 extends from the glass lower frame 115 toward the handle frame 140. The body 22 of the spacer 20 may have a length which allows the spacer 20 to maintain sufficient distance between the outer panel 102 of the door 100 and the glass lower frame 115 when the door 100 sustains an impact. In the disclosed embodiment, the body 22 of the spacer 20 is formed in the shape of a post. It is contemplated that forming the spacer 20 in the shape of a post allows for the spacer 20 to maintain sufficient distance between the outer panel 102 of the door 100 and the glass lower frame 115, while using less material to manufacture the spacer 20 and occupying less space within the door 100. However, it is contemplated that a person having ordinary skill in the art that would appreciate that the spacer 20 may be formed in any shape which may be compatible with the safety system 10. Additionally, it is contemplated that an alternative shape may be compatible with the safety system 10 if the alternative shape is capable of maintaining spacing and/or a distance between the outer panel 102 of the door 100 and the glass lower frame 115 when the door 100 sustains an impact.

[0028] As illustrated by Figure 5, which does not include the safety system 10 and/or the spacer 20, due to the positioning of the door locking rod 180 between the glass lower frame 115 and the outer panel 102 of the door 100 and/or the handle frame 140, the door locking rod 180 may get trapped (pinched) between the glass lower frame 115 and the outer panel 102 of the door 100 and/or the handle frame 140 as a result of impact sustained by the door 100. It is contemplated that the term "impact" as used herein may be understood to mean force exerted and/or a load acting on the outer panel 102 of the door 100 which causes the outer panel 102 to be deformed. Additionally, it is contemplated that the force exerted and/or load acting on the outer panel 102 of the door is in a direction of the glass lower frame 115. Deformation of the outer panel 102 may cause the outer panel 102 to move closer to the glass lower frame 115 and thus displace the door locking rod 180 and/or trap the door locking rod 180 against the glass lower frame 115. Displacement of the door locking rod 180 and trapping the door locking rod 180 against the glass lower frame 115 may cause the door lock 160 to transition to the unlocked state and be maintained in the unlocked state, unintentionally moving the door 100 to the open

condition. As shown in Figure 6, under "normal/desired behavior" of the door locking rod 180 when an impact has been sustained by the door 100, the door lock 160 is not maintained in the unlocked state due to momentary displacement of the door locking rod 180, and the door 100 is not able to move into the open condition. However, under "actual behavior" of the door locking rod 180 when an impact has been sustained by the door 100, the door locking rod 180 is displaced and trapped between the glass lower frame 115 and the outer panel 102 of the door 100, the door lock 160 is maintained in the unlocked state, and the door 100 unintentionally moves into the open condition.

[0029] In operation, the spacer 20, and thus the safety system 10, is configured to prevent the door locking rod 180 from being trapped between the glass lower frame 115 and the outer panel 102 of the door 100. To prevent the door locking rod 180 from being trapped between the glass lower frame 115 and the outer panel 102 of the door 100, the spacer 20 is configured to contact the glass lower frame 115 when the outer panel 102 of the door 100 is deformed, as the handle frame 140 and the spacer 20 and/or the outer panel 102 of the door 100 move closer to the glass lower frame 115 when an impact is sustained by the door 100. In the disclosed embodiment, contact between the spacer 20 and the glass lower frame 115 maintains spacing and/or a distance between the outer panel 102 of the door 100 and the glass lower frame 115 when an impact is sustained by the door 100. Additionally or alternatively, the spacer 20 may be configured to transfer the force exerted and/or the load acting on the outer panel 102 of the door 100 to the glass lower frame 115 to deform the glass lower frame 115 when an impact is sustained by the door 100. As such, it is contemplated that the spacer 20 contacts the glass lower frame 115 and may deform the glass lower frame 115 due to and/or with the impact sustained by the door 100 (the force exerted and/or the load acting on the outer panel 102 of the door 100 in the direction from the spacer 20 to the glass lower frame 115). It is contemplated that deforming the glass lower frame 115 also maintain spacing and/or a distance between the outer panel 102 and the glass lower frame 115. Maintaining spacing and/or a distance between the outer panel 102 of the door 100 and the glass lower frame 115 ensures that the door locking rod 180 is not trapped between the outer panel 102 and the glass lower frame 115. As such, the door locking rod 180 is free to move between the outer panel 102 and the glass lower frame 115 when an impact is sustained by the door 100. In this manner, the door lock 160 is prevented from being maintained in the unlocked state, as the door locking rod 180 can no longer be trapped between the glass lower frame 115 and the outer panel 102 when an impact is sustained by the door 100, thereby preventing the door 100 from unintentionally moving to the open condition.

[0030] Although the present disclosure herein has been described with reference to particular embodiments, it is to be understood that these embodiments are

merely illustrative of the principles and applications of the present disclosure.

[0031] It is intended that the specification and examples be considered as exemplary only, with a true scope of the disclosure being indicated by the following claims.

[0032] Additionally, all of the disclosed features of an apparatus may be transposed, alone or in combination, to a method and vice versa.

Claims

1. A spacer (20) for a door locking system (110) of a door (100) of a vehicle, the door locking system including a handle (120), a handle frame (140), and a door locking rod (180), the spacer comprising:

a body (22) having a first end (24) and a second end (26), the body being configured to extend between the handle frame and a glass lower frame (115) arranged within the door of the vehicle; and

wherein, the second end of the body is capable of contacting the glass lower frame to maintain spacing between the handle frame and the glass lower frame when an impact is sustained by the door.

2. The spacer (20) of claim 1, wherein the body (22) of the spacer is configured to extend directly from the handle frame (140) of the door locking system (110).

3. The spacer (20) of any of claims 1-2, wherein the body (22) of the spacer is configured to be integral to the handle frame (140) of the door locking system (110).

4. The safety system (10) of any of claims 1-3, wherein the spacer (20) is configured to overlap with the glass lower frame (115).

5. A safety system (10) for a door (100) of a vehicle, the door of the vehicle including an outer panel (102), an inner panel (104), and a glass lower frame (115) configured to hold glass between the outer panel and the inner panel, the safety system comprising:

a handle (120) configured to allow a user to open the door of the vehicle;

a handle frame (140) configured to support the handle, at least a portion of the handle frame being arranged between the outer panel and inner panel of the door of the vehicle;

a door lock (160) configured to transition between a first position and a second position;

a door locking rod (180) configured to transition the door lock between the first position and the second position;

the spacer (20) according to any of claims 1-4;
wherein, the spacer is capable of contacting the
glass lower frame to maintain spacing between
the outer panel of the door and the glass lower
frame when an impact is sustained by the door. 5

6. The safety system (10) of claim 5, wherein the spacer
(20) is distanced from the outer panel (102) of the
door (100) by the handle frame (140).

10

15

20

25

30

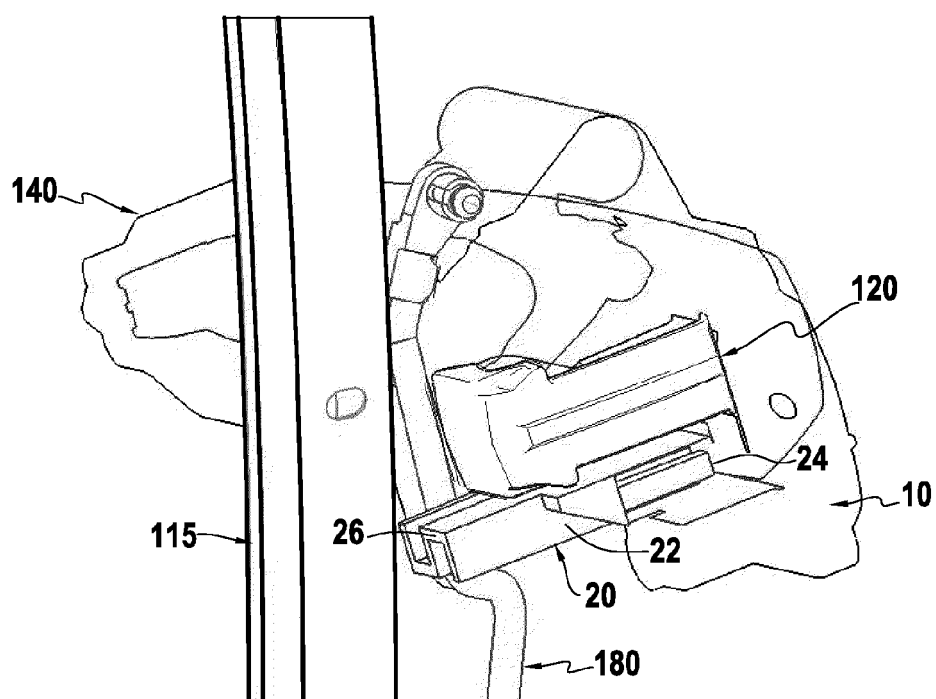
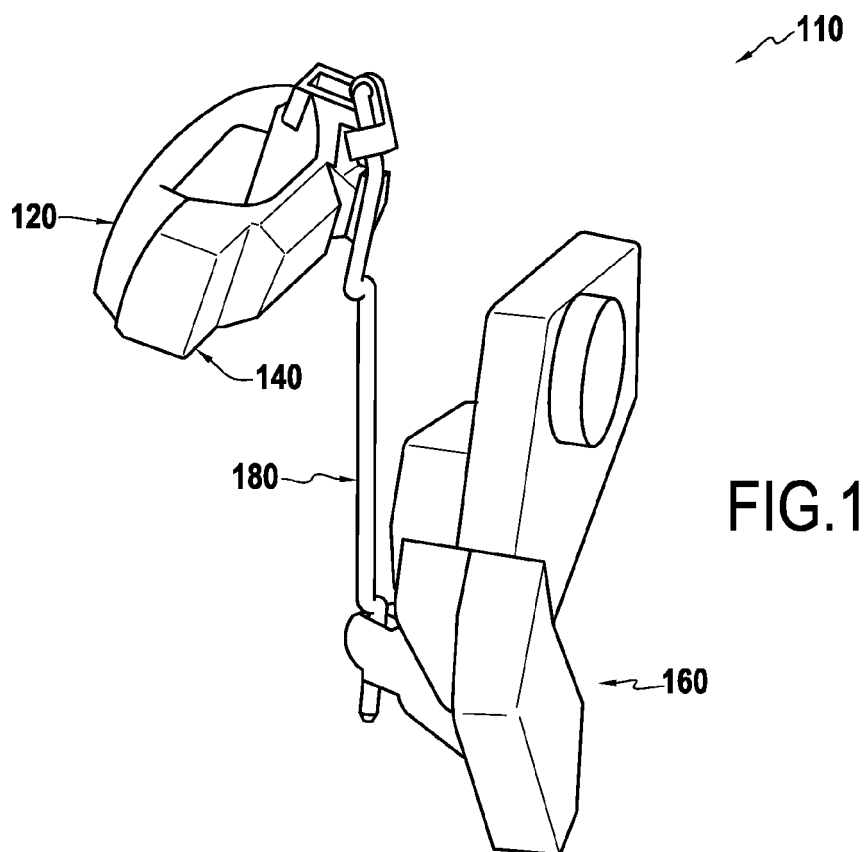
35

40

45

50

55



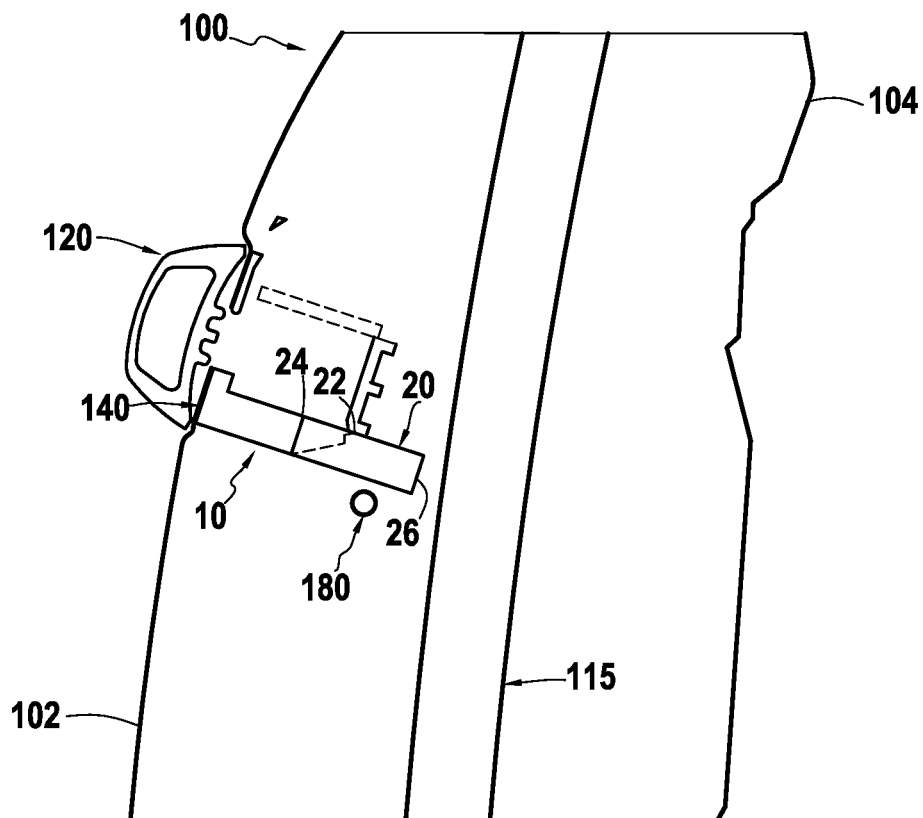


FIG.3

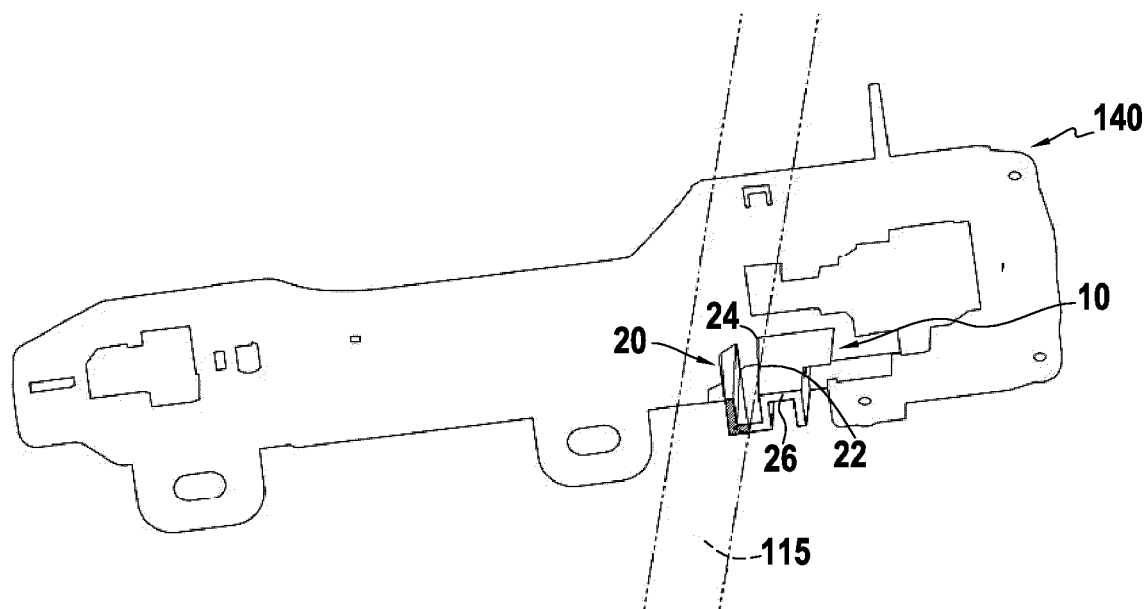


FIG.4

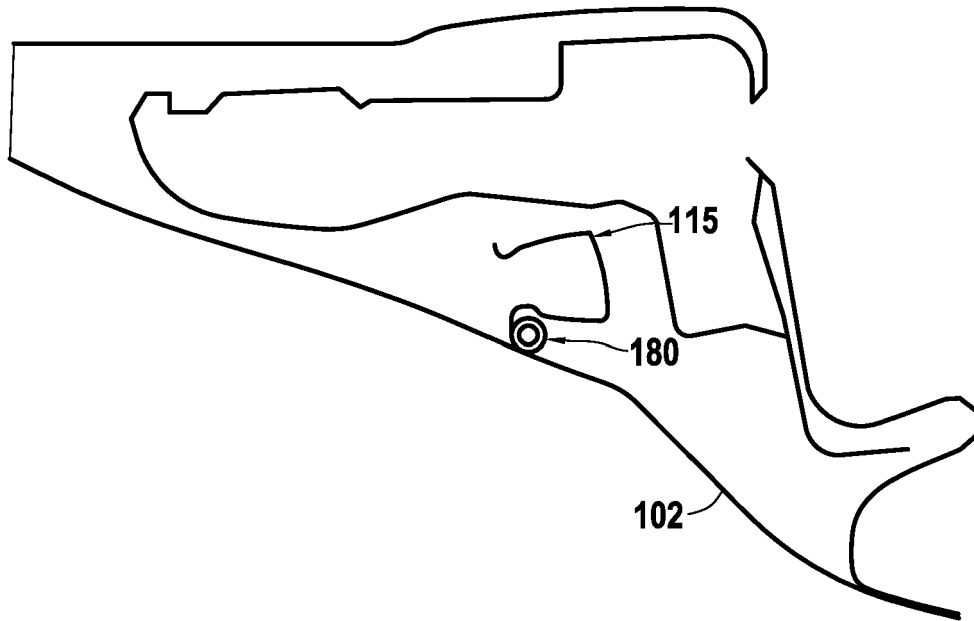


FIG. 5

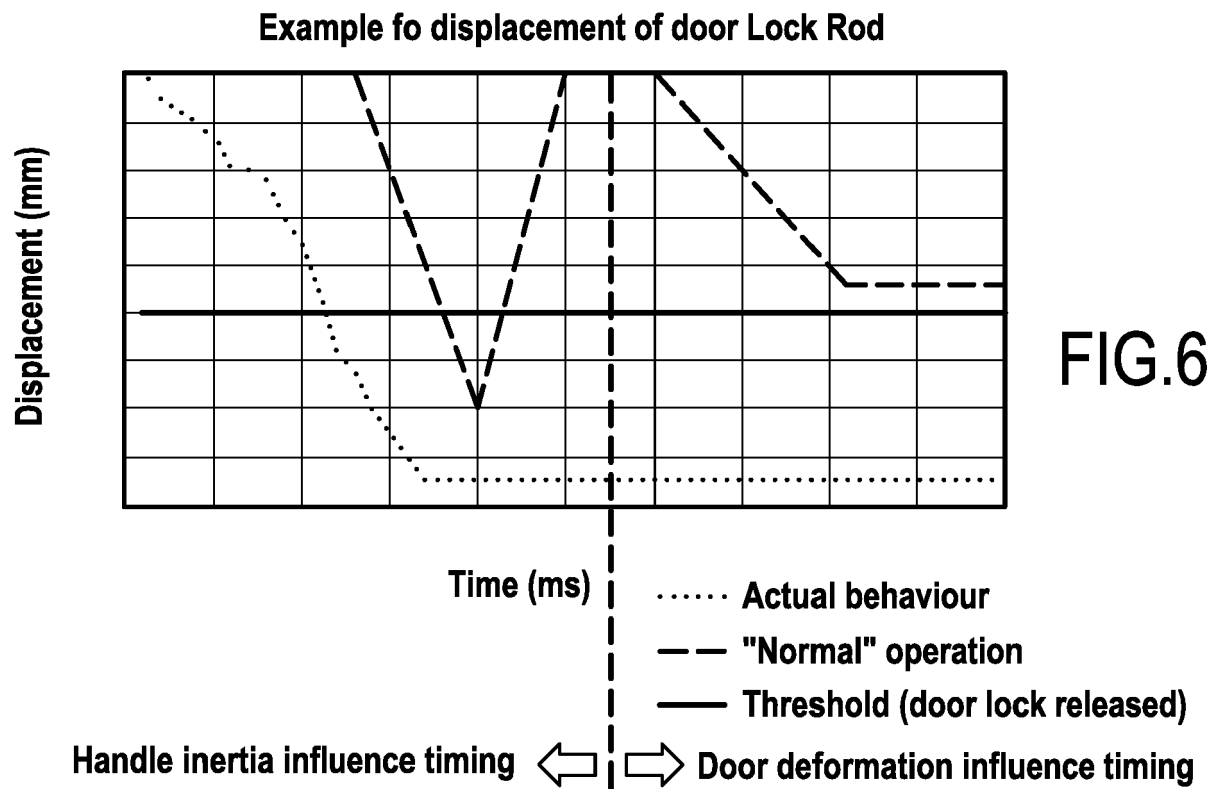


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
EP 20 19 3464

5

10

15

20

25

30

35

40

45

50

55

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	FR 2 980 505 A3 (RENAULT SA [FR]) 29 March 2013 (2013-03-29) * the whole document *	1-6	INV. E05B77/04
X	US 2015/069764 A1 (KERR III NORMAN CHARLES [US]) 12 March 2015 (2015-03-12) * the whole document *	1	
X	US 2015/224858 A1 (YOSHIMOTO KEIICHIROU [JP]) 13 August 2015 (2015-08-13) * the whole document *	1,5,6	
X	US 8 833 812 B2 (SAKAI YASUNARI [JP]; YAMAMOTO TAKAO [JP] ET AL.) 16 September 2014 (2014-09-16) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			E05B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 3 March 2021	Examiner Westin, Kenneth
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 19 3464

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-03-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2980505 A3	29-03-2013	NONE	
US 2015069764 A1	12-03-2015	NONE	
US 2015224858 A1	13-08-2015	DE 102015201819 A1 JP 6450958 B2 JP 2015151707 A US 2015224858 A1	13-08-2015 16-01-2019 24-08-2015 13-08-2015
US 8833812 B2	16-09-2014	CA 2766241 A1 JP 5170314 B2 JP WO2011013242 A1 US 2012119519 A1 WO 2011013242 A1	03-02-2011 27-03-2013 07-01-2013 17-05-2012 03-02-2011

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 102008011754 [0004]