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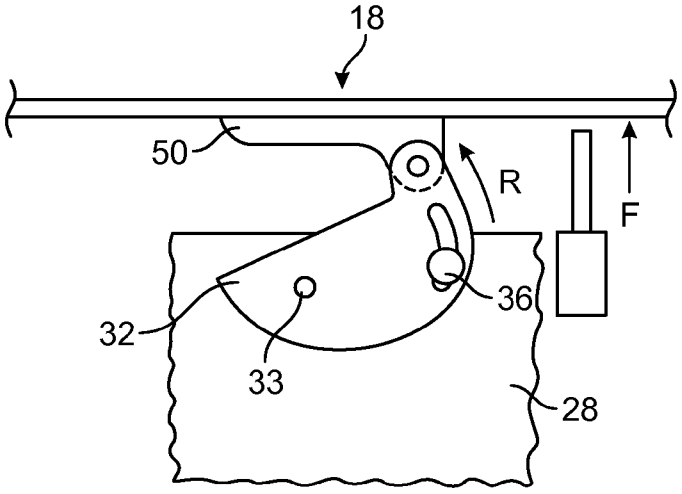

FIG. 2C

(57) Abstract: A hinge mechanism (30) for connecting a bonnet (18) to a motor vehicle (10) allows a portion of the bonnet that is closest to the vehicle's windscreen (21) to be raised by a mechanism (25) such as an airbag (27) deployed by an airbag module located in the engine compartment (16). A hinge member fixed to the wheel well housing (26) does not move when the bonnet is raised or lowered during normal operation but does move when the mechanism inside the engine compartment is activated.

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HINGE MECHANISM FOR CONNECTING A BONNET TO A MOTOR VEHICLE

Field of the invention

[0001] The present invention relates to a hinge mechanism for connecting a bonnet to a motor vehicle that facilitates the raising of a portion of the bonnet nearest the vehicle's windscreen in the event of a collision with a pedestrian.

Background of the invention

[0002] There continues to be a need to provide improved ways to reduce the injuries suffered by a pedestrian, cyclist or animal that is struck by a motor vehicle. This can be done for instance by raising the bonnet of a vehicle to lessen the impact of the pedestrian with the vehicle components located in the engine compartment.

Discussion of the prior art

[0003] US 2006/0175115 A1 discloses a device for reducing the impact for pedestrians wherein a bonnet lifting device has two separate airbags located near the hinges at the part of the bonnet nearest the windscreen. During their deployment the each airbag causes the associated hinge mechanism to raise the portion of the bonnet nearest the windscreen. The hinge mechanism allows the bonnet to be raised at the front of the vehicle during normal use. When the airbag is deployed it causes a pin to move towards the front of the vehicle in a guide slot, this causes a pivot point of the hinge to move forwards causing the arms of the hinge to raise the rear portion of the

bonnet giving the airbags an opening to deploy over the windscreen. That is to say a pivot point of the articulated hinge is moved when the airbag is deployed resulting in the lifting of the rear section of the bonnet.

[0004] US 2008/0093150 A1 discloses a pedestrian protection bonnet lifting system wherein a device that causes the rearward portion of a bonnet to be raised has a spring that is under load, the load is released by a mechanism that releases the load, for example by retracting a stop, the spring then causes a piston to move. In a first embodiment the moving piston forces air into an inflatable body that causes the bonnet to be raised. In another embodiment the piston causes an articulated hinge to move and raise the bonnet. In yet another embodiment one end of a leaf spring is attached to the piston and when tension of the coil spring is released the other end of the leaf spring causes the bonnet to be raised. A claimed advantage of this device is that it can be readily reset if the bonnet is raised without interacting with a pedestrian.

[0005] US 2009/0288271 A1 discloses an over center sprung bonnet hinge for use with an active pedestrian protection system wherein two arms of a hinge are joined together by a pivot. An over center spring has one end of the spring attached to each of the hinge arms. When an actuator causes a piston to move upward and push on the upper of the two hinge arms, the upper hinge arm engages a bottom surface of the vehicle's hood. The over center spring limits the travel of the upper hinge arm. A pin extending through a slot in the lower hinge arm also aids in limiting the travel of the upper hinge arm. While the vehicle hood may be manually pushed back into place after the deployment device has been activated, the device will not operate properly again until after it has been serviced.

[0006] US 2009/0289473 A1 discloses a key cam system for hinge with active pedestrian protection system wherein two arms of a hinge are joined together by a

pivot. A cam mechanism locks the hinge in a closed position. When an actuator causes a piston to move upward and push on the upper of the two hinge arms a shear pin is broken by the movement of the piston. A cam moves along a cam path in the cam mechanism to limit the upward movement of the upper hinge arm and the vehicle hood. While the vehicle hood may be manually pushed back into place after the deployment device has been activated, the device will not operate properly again until after it has been serviced.

[0007] EP 2351671 A1 discloses a hinge mechanism for connection of a vehicle bonnet to the vehicle wherein a hinge has an upper hinge wing with upper and lower parts that are articulately connected with each other. A relative motion of the upper part takes place in relation to the lower part from a normal position into a crash position after separation of a connection fixing the upper part with the lower part by a separating mechanism. The upper part lies in a normal position over a stopper element against a limiting element of the lower part. A contact surface extends parallel to an adjustment direction of the upper part in relation to the lower part. The stopper and limiting element may have a plastic coating.

[0008] WO 2009/011731 A1 discloses a pedestrian protection airbag system wherein a mechanical device functions as both a hinge allowing the bonnet to be raised at the front of a vehicle and as a release allowing a region of the hood closest to the windscreen to be lifted when an airbag stored below the bonnet in this region is deployed, the bonnet being lifted by the deploying airbag. The mechanical device comprises a deformable articulated arm that is deformed when a threshold pressure point is overcome allowing the region of the bonnet nearest the windscreen to be raised by the airbag. A joint with a detent limits movement of the device to allow raising the bonnet from the front of the vehicle, but when the airbag causes the deformable arm to override the detent the deformable arm facilitates raising the portion of the bonnet nearest the windscreen.

[0009] JP 2004-322724 discloses a device for protecting a pedestrian wherein when an airbag is deployed, the length in a vehicular width direction is shortened. A lock pin is pulled out from a hole in the hinge mechanism by a wire, thereby releasing locking of a hinge mechanism. This device is undesirable because the lock pin can become jammed in the locking hole such that both movement mechanisms namely the lifting of the hood by the airbag and the removal of the lock pin from the locking hole block each other.

Summary of the invention

[0010] There is provided in accordance with one aspect of the present invention a hinge mechanism for connecting a bonnet to a motor vehicle including a first hinge member that is fixed directly or indirectly to a second hinge member which can be a mounting surface or component of the motor vehicle in a region adjacent a side fender, a structural beam or support or an engine compartment of the motor vehicle. The first hinge member is oriented at least substantially vertical, the first hinge member has at least one slot therein and at least one stationary motion guiding pin that is disposed in the at least one slot, at least one securing member which places a securing force on the first hinge member. The hinge mechanism is configured to permit the bonnet to be lifted during normal vehicle operation to gain access to the engine compartment. However, during a pedestrian protection mode of operation, the hinge mechanism permits that part of the bonnet closer to the windshield to be lifted while still being securely connected to the vehicle. In some embodiments the hinge mechanism includes at least one connecting bar interconnecting the bonnet and first hinge member while in other embodiments the connecting bar is eliminated and a pivot hinge is substituted.

[0011] There is provided in accordance with another aspect of the present invention a hinge mechanism for connecting a bonnet to a motor vehicle comprising: a first hinge member that is fixed directly or indirectly to a second hinge member which can be a mounting surface or component of the motor vehicle whereby the first hinge member is oriented at least substantially vertical, the first hinge member having at least one curved slot therein, the first hinge member is fixed to the second hinge member via a first pivot pin and at least one stationary motion guiding pin that is disposed in the at least one curved slot.

[0012] There is provided in accordance with yet another aspect of the present invention a hinge mechanism for connecting a bonnet to a motor vehicle comprising: a first hinge member that is fixed directly or indirectly to a second hinge member which could be a mounting surface or component of the motor vehicle whereby the first hinge member is oriented at least substantially vertical, the first hinge member having at least two slots therein, each of the slots has a stationary motion guiding pin that extends through the slot and the first hinge member is fixed to the motor vehicle via the stationary motion guiding pins, each of the stationary motion guiding pins having a fixing member attached thereto which places a securing force on the first hinge member; a first connecting bar fixed to the first hinge member via a first pivot pin and to the bonnet via a second pivot pin, and a second connecting bar fixed to the first hinge member via a third pivot pin and to the bonnet via a fourth pivot pin.

Brief description of the drawings

[0013] Fig. 1A is a schematic side view, partially broken away, of a motor vehicle equipped with a hinge mechanism of the present invention in a normal configuration.

[0014] Fig. 1B is a schematic side view, partially broken away, of the motor vehicle of Fig. 1 after a collision with a pedestrian.

[0015] Figs. 2A – 2C are schematic representations, not to scale, of the operation of a first embodiment of a hinge mechanism of the present invention.

[0016] Figs. 3A and 3B are side views of a hinge mechanism according to the first embodiment of the present invention immediately preceding and immediately following an impact of a motor vehicle with a pedestrian, cyclist or animal.

[0017] Figs. 4A – 4C are schematic representations, not to scale, of the operation of a second embodiment of a hinge mechanism of the present invention.

[0018] Figs. 5A and 5B are side views of a hinge mechanism of a second embodiment of the present invention immediately preceding and immediately following an impact of a motor vehicle with a pedestrian, cyclist or animal.

Detailed description of the Invention

[0019] Referring first to Figs. 1A and 1B, a motor vehicle 10 is shown equipped with a hinge mechanism 30 according to a first embodiment of the invention. A front bumper 12 of the motor vehicle is provided with a sensor 14 that senses an impact of the motor vehicle with a pedestrian, bicycle, animal or other similar roadway obstruction. A bonnet or hood 18 covers the engine compartment 16 of the motor vehicle. In normal operation a front portion 19 of the bonnet 18 that is furthest from a windscreen 21 of the motor vehicle is raised to provide access to the engine compartment 16 by releasing a latch 13 in a well known manner then lifting the front portion 19 of the bonnet while a hinge mechanism 30 allows a rear portion 20 of the bonnet to pivot. The hinge mechanism 30 is preferably fixed directly or indirectly to a vehicle mounting component

such as a waterbox, a side fender, a structural beam or support member or other component adjacent the engine compartment such that a first hinge member 32, described in more detail below, is oriented at least substantially vertical. An airbag module 25 having at least one airbag 27 and an inflator 27A operatively connected to the airbag 27, the airbag is located under the bonnet 18 and when inflated generates a force on the underside of the rear portion 20 of the bonnet. It is to be understood of course that in a conventional manner a hinge mechanism is associated with each lateral side of the bonnet. Fig. 1A shows the motor vehicle in a normal operating configuration. Fig. 1B shows the motor vehicle in a configuration after airbag 27 has been activated with the rear portion 20 of the bonnet lifted. In this configuration, sensor 14 sensed the bumper 12 was impacted a pedestrian and sends signal to the airbag module 25 causing the airbag inflator 27A to inflate the airbag 27 and deploy the airbag upwardly raising the rear portion 20 of the bonnet 18, creating a gap 26 between the bonnet and the windscreen 21 through which a portion of the airbag is deployed to cover a portion of the windscreen. It is common that when the bumper of a motor vehicle impacts a pedestrian that the pedestrian is launched onto the top of the bonnet and impacts the windscreen of the motor vehicle. When a mechanism located inside the engine compartment raises the rear portion of the bonnet the impact of the pedestrian with the vehicle components in the engine compartment is reduced and an airbag covering at least a portion of the windscreen reduces the impact of the pedestrian with the windscreen. While an impact sensor is contemplated preferably mounted at the bumper location 12, the sensor may be configured as forward looking camera at the top windshield (windscreen) and may also include night vision capabilities

[0020] Figs. 2A – 2C are schematic representations, of the operation of a first embodiment of a hinge mechanism 30 of the present invention. Figs. 2A – 2C are best understood when viewed in conjunction with Figs. 1A and 1B as described above. As best seen in Fig. 2A which is a schematic side elevation view, a first hinge member 32 is oriented substantially vertically and is fixed directly or indirectly to a second hinge member 28 which can also be mounting component 28 of the motor vehicle. The first

and second hinge members are linked together by a securing member 33 that creates a clamping force F on the first hinge member 32 and on the second hinge member 32 and also permits the first hinge member to rotate relative to the second hinge member 28. The securing member may be any suitable securing member such as: a threaded fastener secured by a nut or lock washer; a rivet; or stud secured in place with a push on end cap. The value of the securing force F may be controlled using for example a torque wrench or an electronic force sensor. As will be explained later the securing member 33 also functions as a pivot pin.

[0021] With reference to Figs. 2B and 2C which are schematic presentations of the operation of a hinge mechanism described with reference also to Figs. 1A and 2A, the first hinge member 32 Is provided with at least one slot 34 therein and at least one stationary motion guiding pin 36 that is disposed in the at least one slot 34. The slot in the first hinge member 32 is a blind slot that is closed on both ends, that is to say, the slot 34 and stationary motion guiding pin 36 limit the motion of the first hinge member 32 relative to the second hinge member 28 when the first hinge member is rotated or pivoted about the securing member 33 as shown by arrow R in a manner that will be described later. In the illustrated embodiment bonnet 18 is connected to the first hinge member 32 by another hinge mechanism 32A which permits the bonnet to be rotated (raised) to service the engine and then lowered. In general, the slot can reside in either the first or the second hinge member and the motion guiding pins can extend from the hinge member that does not have the slot.

[0022] When a front portion 19 of the bonnet 18 is raised to provide access to the engine compartment 16, or lowered, the bonnet rotates about a hinge mechanism 32A. During this time the securing force F acting on the first and second hinge members 32 and 28 is sufficient to prevent relative motion between these to hinge members. During a pedestrian accident situation, the rear portion 20 of the bonnet t is raised by an upwardly directed force F2, the level of force F2 is sized to overpower the securing force F acting on first second hinge members to permit the first hinge member 32 to rotate relative to the second hinge member 28, this rotation is indicated by arrow R in

Fig. 2B. As the first hinge member 32 rotates about pin 33, the position of the stationary motion guiding pin 36 moves with slot 34. The amount of rotation of the first hinge member is limited by the length of the curved slot 34, the magnitude and duration of force F2. Any suitable force generating mechanism such as one powered by an electric motor, spring, or pyrotechnic piston or airbag may be employed to produce the lifting force F2 on an underside of the bonnet. In the illustrated embodiment an air bag 27 is used to raise portion 20 of the bonnet 18. As shown in Fig. 1B the deployed airbag 27 extends through a gap 26 that is formed between the windscreen and the bonnet when the rear portion 20 of the bonnet 18 is raised by the deploying airbag in response to the motor vehicle interacting with for example a pedestrian, cyclist or animal. The level of the securing force F on the first hinge member 32 and the level of the lifting force F2 on the bonnet are selected using good engineering practices for any given motor vehicle. Figure 2C diagrammatically shows a telescoping pyrotechnically actuated piston mechanism 140 can be used as an alternate to airbag 27 to lift the rear portion 20 of the bonnet 18. Upward motion of the mechanism 140 lifts the rear portion of the bonnet 20.

[0023] Referring next to Figs. 3A and 3B which are side views of a hinge mechanism 30a according to another embodiment of the present invention are shown. Fig. 3A shows the hinge mechanism 30a during normal vehicle operation and Fig. 3B shows the hinge mechanism immediately following an impact of the motor vehicle with a pedestrian, cyclist or animal with the rear of the bonnet lifted.

[0024] A hinge mechanism 30a has a first hinge member 32 that is fixed directly or indirectly to a second hinge member 28 which can be a component of the motor vehicle 10 in the same manner as member 32 of hinge mechanism 30. The first hinge member is oriented at least substantially vertical. The first hinge member has at least one curved slot 34 therein with at least one stationary motion guiding pin 36 that is disposed in the at least one curved slot. The first hinge member 32 is fixed directly or indirectly to the component of the motor vehicle via a securing member 33 that functions also as a first pivot pin 33 and places a securing force F on the first hinge member. A first connecting bar 38 is fixed to the first hinge member 32 via a second pivot pin 39 and

directly or indirectly the bonnet 18 via a third pivot pin 40 A second connecting bar 41 is fixed to the first hinge member 32 via a fourth pivot pin 42 and directly or indirectly to the bonnet via a fifth pivot pin 43. In the illustrated embodiment pivot pins 40 and 43 are connected to another hinge or support member 50 that is fixed to or is part of the bonnet 18. In this embodiment the two connecting bars, the hinge members 32 and 28 and the support member 50 form a 4-bar linkage guiding the motion of the bonnet. As can be appreciated one of the connecting bars and its two associated pins can be removed.

[0025] The bonnet in this embodiment will operate much the same as the bonnet in shown with the hinge configuration of FIGs. 2A – 2C. A portion 19 of the bonnet 18 that is furthest from the windscreen 21 of the motor vehicle 10 can be raised and lowered with hinge members 32 and 28 remaining together by virtue of the securing force F. When a sufficiently large force F2 is applied to the rear portion 20 of the bonnet 18, hinge portions 32 and 28 rotate relative to one another permitting the rear portion 20 of the bonnet to lift, Figure 3B schematically shows another force production mechanism to lift the rear portion 20 of the bonnet; this mechanism includes a rack and pinion mechanism 142, 143, the pinion being rotated by an electric motor 146. Upward motion of the rack 144 lifts portion 20 of the bonnet 18.

[0026] Figs. 4A – 4C are schematic representations, of the operation of a further embodiment of a hinge mechanism 70 of the present invention. Figs. 4A – 4C are best understood when viewed in conjunction with Figs. 1A and 1B as described above. As best seen in Fig. 4A which is a schematic side elevation view, a first hinge member 72 is fixed directly or indirectly to a second hinge component 28 which as mentioned could be a component of the motor vehicle. The first hinge member 72 is oriented at least substantially vertical. The first hinge member 72 has at least one vertically oriented slot 74 therein and a stationary motion guiding pin 76 is disposed in the slot, the guide pin can be fixed to the second hinge component 28. The stationary motion guiding pin 78 has a securing member, such as a head of the stationary guiding pin, which places a securing force F on the first hinge member. The stationary motion guiding pin may be any suitable item such as: a threaded fastener secured by a nut or lock washer; a rivet;

or stud secured in place with a push on end cap. The value of the securing force F may be controlled using for example a torque wrench or an electronic force sensor.

[0027] With reference to Figs. 4B and 4C which are also schematic presentations of the operation of / hinge mechanism 70 is described with reference also to Figs. 1A and 2A. The bonnet 18 is connected to the first hinge mechanism 72 via another hinge mechanism 32A as previously described in conjunction with figures 2A – 2C permitting the raising and lowering of the bonnet.

[0028] During a pedestrian accident situation, the rear portion 20 of the bonnet t is raised by an upwardly directed force F2. As also previously mentioned, the level of force F2 is sized to overpower the securing force F acting on first second hinge members to permit the first hinge member 32 to slide upwardly relative to the second hinge member 28 lifting the rear portion 20 of the bonnet; this motion can be seen when comparing FIGS 4B and 4C.

[0029] Referring next to Figs. 5A and 5B side views of a hinge mechanism 70a according to an additional embodiment of the present invention are shown. Fig. 5A shows the hinge mechanism during normal vehicle operation and Fig. 5B shows the hinge mechanism immediately following an impact of the motor vehicle with a pedestrian, cyclist or animal.

[0030] A hinge mechanism 70a is similar to hinge mechanism 30a of FIGS 3A and 3B with the general exception the curved slot 34 has been replaced with two substantially vertical closed ended slots 74 and 75. Each of the slots is associated with a stationary motion guiding pin 76, 77 that is disposed in a respective slot, each pin is connected to or formed in a second hinge member 28. The slots are preferably straight and closed at both ends to limit the travel of the first hinge member upward in a manner to be described later. The first hinge member 72 is fixed directly or indirectly to the second hinge member 28 via the stationary motion guiding pins 76, 77. Each of the stationary motion guiding pins 76, 77 has a securing member which places a securing force F on the first hinge member. The securing member may be the head of a screw, a nut, a washer or an end cap that pulls on the first hinge member to secure the first hinge

member stationary relative to the second hinge member during normal operation of the vehicle.

[0031] In this embodiment as with the embodiment in Figs 3A and 3B the bonnet is connected to the first hinge member by a 4-bar linkage comprising a first and second connecting bar, second hinge member 90, a portion of the first hinge member 72 and various pivot pins. The first connecting bar 80 is fixed to the first hinge member 72 via a first pivot pin 82 and directly or indirectly to the bonnet 18 via a second pivot pin. The second connecting bar 81 is fixed to the first hinge member via a third pivot pin 84 and directly or indirectly to the bonnet via a fourth pivot pin 85. As shown in Figs. 5A and 5B the connecting bars 80, 81 are connected to the second hinge member 90 via the second 83 and fourth 85 pivot pins, and the second hinge member is fixed directly or indirectly to the bonnet and is located between the bonnet and the connecting bars 80, 81.

[0032] As already described above when a portion 19 of the bonnet 18 that is furthest from the windscreen 21 of the motor vehicle 10 is raised to provide access to the engine compartment 16 the bonnet moves upwardly with the securing force F on the first hinge member 72 being sufficient to prevent the first hinge member from moving upward. However, when a rear portion 20 of the bonnet is raised by an upwardly directed force F2 generated by a mechanism the securing force F on first hinge member 72 is not sufficient to prevent the first hinge member from being moved upward As the bonnet raises the stationary motion guiding pins 76, 77 that are disposed in the slots 74, 75 go from being located at the tops of the slots to being located at the bottom of the slots. It is understood that while this embodiment is shown with two slots, one slot or more than two slots may be employed in the practice of this embodiment of the present invention.

[0033] As related above any suitable mechanism such as one powered by an airbag, electric motor, spring, or pyrotechnic device may be employed to produce the lifting force F2 on an underside of the bonnet. As shown in Fig. 1B an exemplary deployed airbag 27 extends through a gap 26 that is formed between the windscreen and the bonnet when the portion 20 of the bonnet 18 is raised by deploying the airbag in response to the motor vehicle interacting with a pedestrian, cyclist or animal. The value

of the securing force F on the first hinge member and the value of the lifting force F2 on the bonnet are selected using good engineering practices for any given motor vehicle.

[0034] While the invention has been described with reference to certain exemplary embodiments, obvious modifications and alterations are possible by those skilled in the related art. Therefore, it is intended that the invention include all such modifications and alterations to the full extent that they come within the scope of the following claims or the equivalents thereof.

What is claimed is:

1. A hinge mechanism (30; 70) for connecting a bonnet (18) to a motor vehicle (10) comprising:

a first hinge member (32; 72) that is fixed directly or indirectly to a second hinge member (28), the first hinge member having at least one slot (34; 74, 75) therein and at least one motion guiding pin (36; 76, 77) that is disposed in the at least one slot (34; 74, 75), and at least one securing member (33; 73) places a securing force (F) on the first hinge member (32; 72);

and

when the bonnet (18) is raised to provide access to the engine compartment (16) there is no relative motion between the first hinge member and second hinge member (28) but when a rear portion (20) of the bonnet that is nearest the windscreen (21) of the motor vehicle is raised by an activation force of a determinable level (F, F1, F2) generated by a force producing mechanism (27) the securing force (F) is over powered enabling the first hinge member to move relative to the second hinge member (28) and the location of the at least one motion guiding pin (36; 76, 77) in the at least one slot (34; 74, 75) in the first hinge member is changed as the first hinge member moves.

2. The hinge mechanism (30; 70) for connecting a bonnet (18) to a motor vehicle (10) according to claim 1 wherein the hinge mechanism is located relatively close to the rear of the bonnet.

3. The hinge mechanism (30; 70) for connecting a bonnet (18) to a motor vehicle (10) according to claim 1 wherein at least one connecting bar (38, 41; 80, 81) is connected to the bonnet via a second pivot pin and a second hinge member (50, 90),

the second hinge member being fixed to the bonnet and located between the bonnet and the at least one connecting bar.

4. The hinge mechanism (30; 70) for connecting a bonnet (18) to a motor vehicle (10) according to claim 1 wherein the mechanism that raises the portion (20) of the bonnet (18) that is nearest the windscreen (21) of the motor vehicle is one of a pyrotechnic element (140), a motor (146) or an airbag (27) that is deployed by an airbag inflator (27A), the deployed airbag (27) extending through a gap (26) that is formed between the windscreen and the bonnet when the portion (20) of the bonnet (18) that is nearest the windscreen of the motor vehicle (10) is raised.

5. A hinge mechanism (30) for connecting a bonnet (18) to a motor vehicle (10) of claim 3 wherein the first hinge member having at least one curved or straight slot (34) therein with the at least one motion guiding pin (36) disposed in the at least one curved or straight slot;

at least one connecting bar (38) that is fixed to the first hinge member (32) via a second pivot pin (39) and directly or indirectly the bonnet (18) via a third pivot pin (40); and

when a portion (19) of the bonnet (18) that is furthest from a windscreen (21) of the motor vehicle (10) is raised the bonnet moves upwardly with the securing force (F) on the first hinge member (32) being sufficient to prevent the first hinge member from pivoting about the first pivot pin but when a portion (20) of the bonnet (18) that is nearest the windscreen (21) of the motor vehicle is raised by a mechanism the securing force (F) on first hinge member (32) is not sufficient to prevent the first hinge member from pivoting about the first pivot pin with the location of the at least one motion guiding pin (36) in the at least one curved or straight slot (34) in the first hinge member changing as the first hinge member pivots about the first pivot pin.

6. The hinge mechanism (30) for connecting a bonnet (18) to a motor vehicle (10) according to claim 5 wherein the component of the motor vehicle to which the first hinge member (32) is fixed directly or indirectly is a wheel well housing (28) that at least in part defines the engine compartment (16) of the motor vehicle.

7. The hinge mechanism (30) for connecting a bonnet (18) to a motor vehicle (10) according to claim 5 wherein the at least one connecting bar (38, 41) is connected to the bonnet via the third pivot pin (40) and a second hinge member (50), the second hinge member being fixed directly or indirectly to the bonnet and located between the bonnet and the at least one connecting bar (38, 41).

8. The hinge mechanism (30) for connecting a bonnet (18) to a motor vehicle (10) according to claim 5 further comprising two connecting bars (38, 41), the first connecting (38) bar is fixed to the first hinge member (32) via the second pivot pin and directly or indirectly to the bonnet via the third pivot pin, and the second connecting bar (41) is fixed to the first hinge member via a fourth pivot pin (42) and directly or indirectly to the bonnet via a fifth pivot pin (43).

9. The hinge mechanism (30) for connecting a bonnet (18) to a motor vehicle (10) according to claim 8 wherein the first connecting bar (38) is connected to a second hinge member (50) via the third pivot pin (40) and the second connecting bar (41) is connected to the second hinge member via the fifth pivot pin (43) and the second hinge member is fixed to the bonnet and located between the bonnet and the first and second connecting bars (38, 41).

10. A hinge mechanism (70) for connecting a bonnet (18) to a motor vehicle (10) of claim 1 wherein when a portion (20) of the bonnet (18) that is nearest the windscreen

(21) of the motor vehicle is raised by a mechanism capable of producing a sufficient force F2 the securing force (F) on first hinge member is overcome permitting the first hinge member (72) to move upwardly and the locations of the stationary motion guiding pins (76, 77) in the slots (74, 75) in the first hinge member are changed as the first hinge member moves

11. The hinge mechanism (70) for connecting a bonnet (18) to a motor vehicle (10) according to claim 10 wherein the connecting bars (80, 81) are connected to a second hinge member (90) via the second (83) and fourth (85) pivot pins, the second hinge member is fixed directly or indirectly to the bonnet and is located between the bonnet and the connecting bars (80, 81).

12. The hinge mechanism (70) for connecting a bonnet (18) to a motor vehicle (10) according to claim 11 wherein the connecting bars (80, 81) are connected to a second hinge member (90) via the second (83) and fourth (85) pivot pins, the second hinge member is fixed directly or indirectly to the bonnet and is located between the bonnet and the connecting bars (80, 81).

13. The hinge mechanism (70) for connecting a bonnet (18) to a motor vehicle (10) according to claim 10 wherein the mechanism located inside the engine compartment (16) that raises the portion (20) of the bonnet (18) that is nearest the windscreen (21) of the motor vehicle is an airbag (27) that is deployed by an airbag module (25) located in the engine compartment (16), the deployed airbag (27) extending through a gap (26) that is formed between the windscreen (21) and the bonnet when the portion (20) of the bonnet (18) that is nearest the windscreen of the motor vehicle is raised.

14. The hinge mechanism (70) for connecting a bonnet (18) to a motor vehicle (10) according to claim 12 wherein the mechanism that raises the portion (20) of the bonnet (18) that is nearest the windscreen (21) of the motor vehicle is an airbag (27) that is deployed by an airbag module (25) located in the engine compartment (16), the deployed airbag (27) extending through a gap (26) that is formed between the windscreen (21) and the bonnet when the portion (20) of the bonnet (18) that is nearest the windscreen of the motor vehicle is raised.

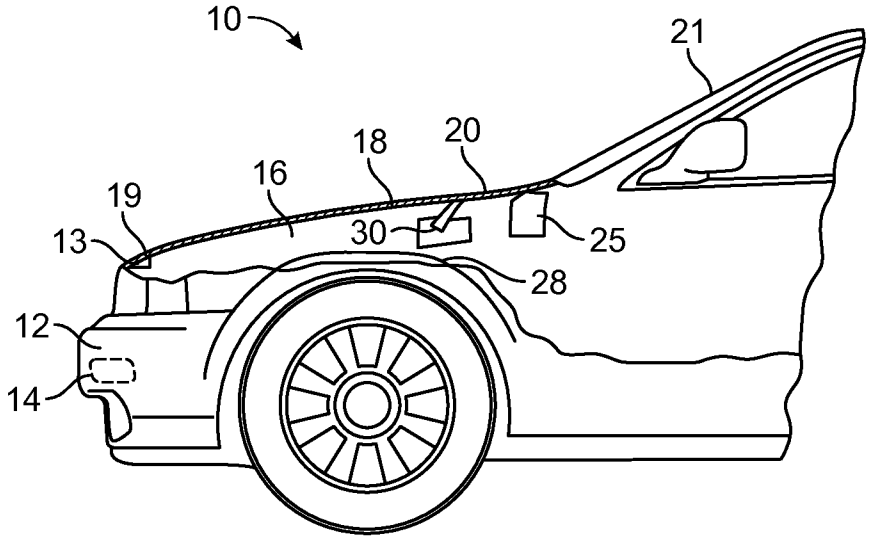
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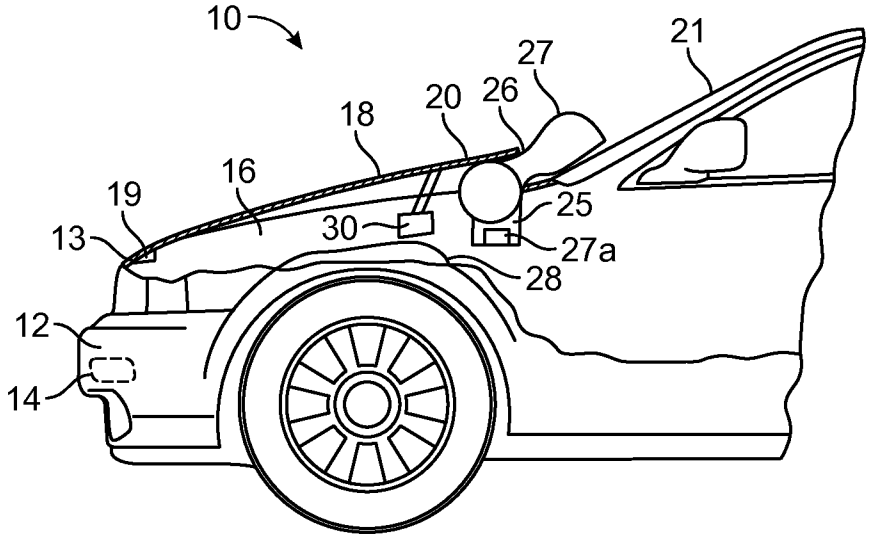
FIG. 1A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27a
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12
14

FIG. 1B

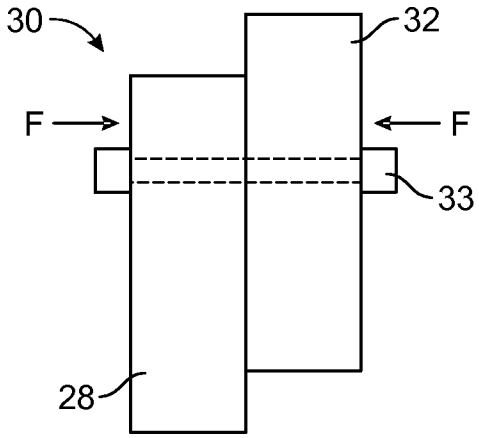


FIG. 2A

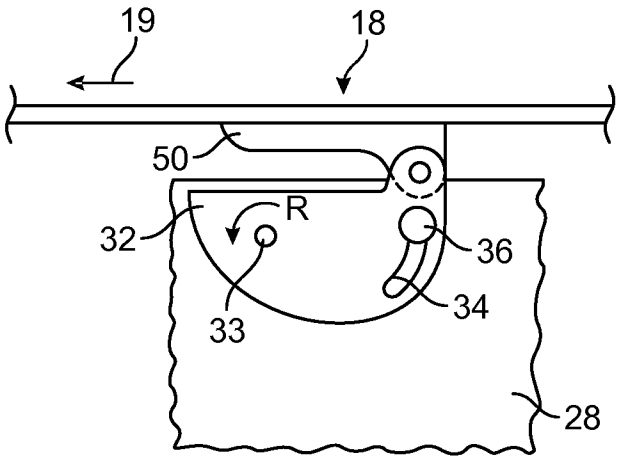


FIG. 2B

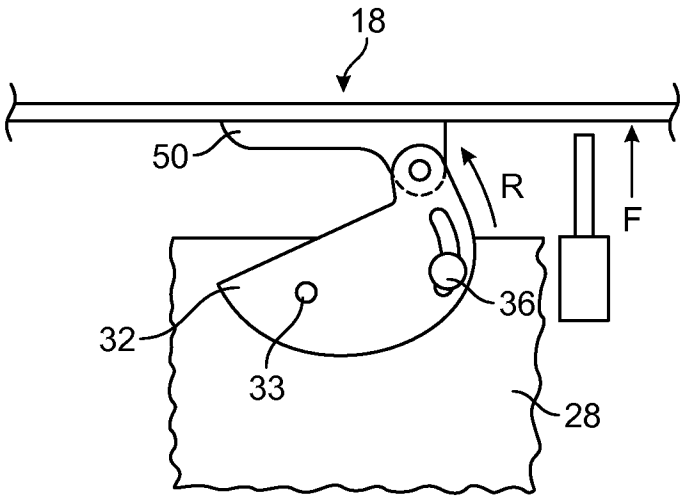
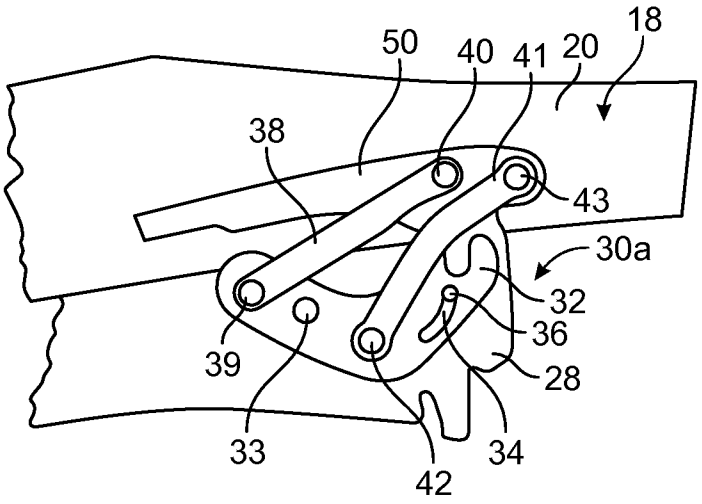


FIG. 2C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50
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41
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38
43
30a
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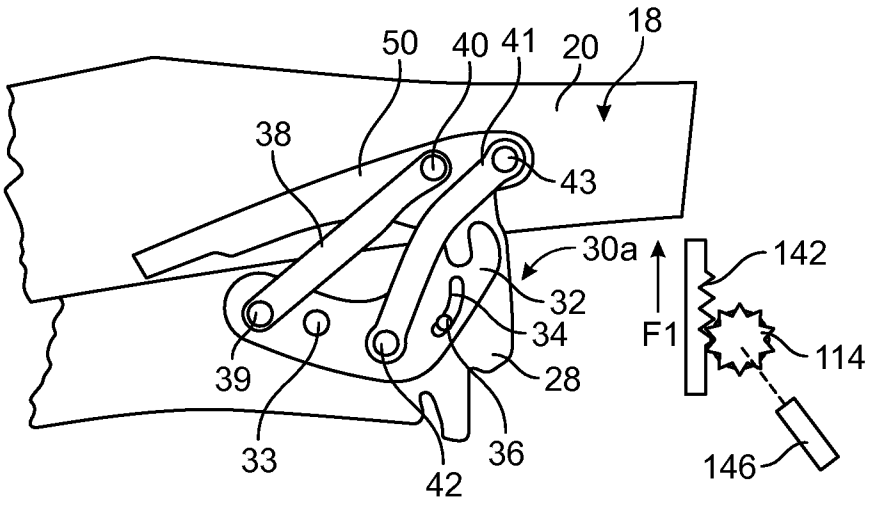
34
42

FIG. 3A


18
50
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38
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30a
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32
F1
34
114
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28
33
36
42
146

FIG. 3B

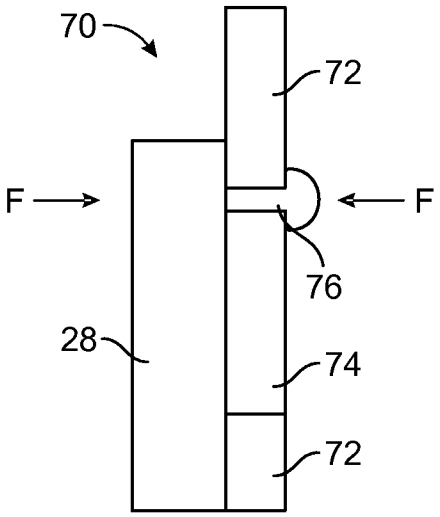


FIG. 4A

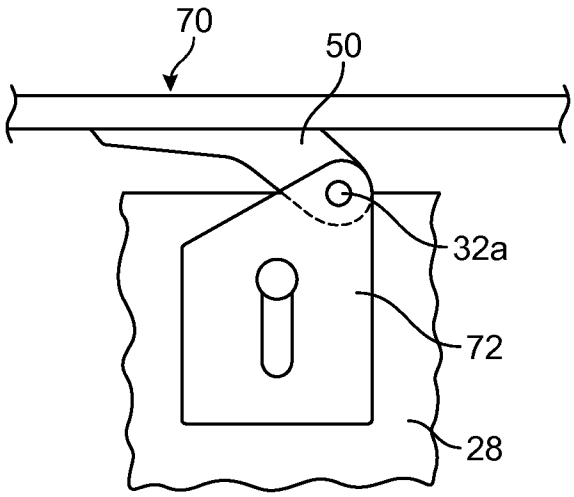


FIG. 4B

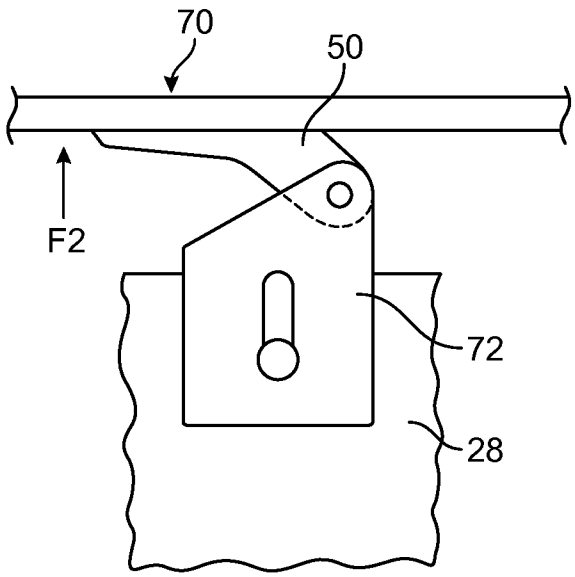
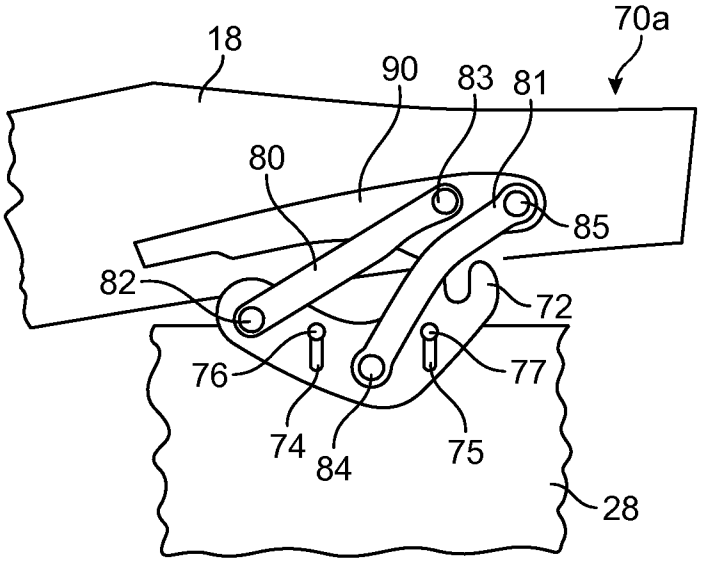


FIG. 4C


70a
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90
83
81
80
85
82
72
76
77
74
84
75
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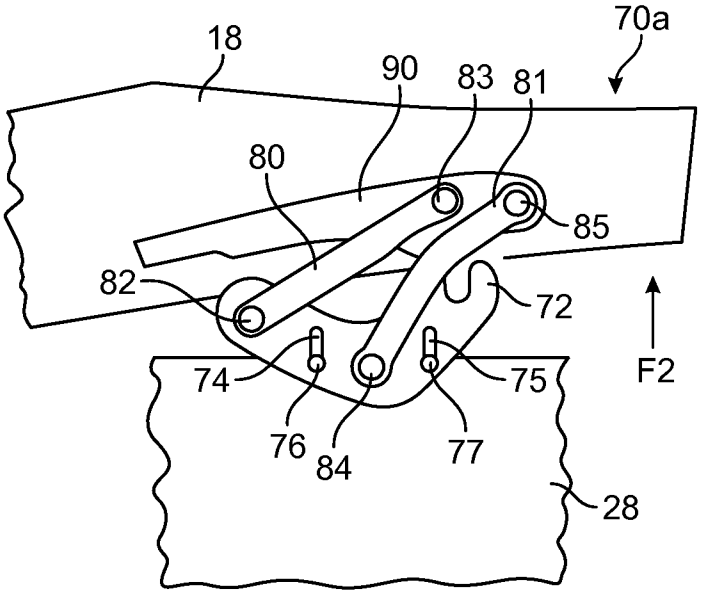
FIG. 5A


70a
18
90
83
81
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85
82
72
F2
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FIG. 5B

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/040497

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60R21/38 E05D3/14
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60R E05D

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2009 040406 A1 (BAYERISCHE MOTOREN WERKE AG [DE]) 10 March 2011 (2011-03-10) paragraph [0039]; claim 9; figure 1	1,3,10
X	DE 10 2008 046145 A1 (BAYERISCHE MOTOREN WERKE AG [DE]) 11 March 2010 (2010-03-11) figures 1-3	1,3
X	US 2006/175115 A1 (HOWARD MARK [DE]) 10 August 2006 (2006-08-10) cited in the application figure 2	1,2
A	JP H11 20740 A (NISSAN MOTOR) 26 January 1999 (1999-01-26) paragraphs [0025] - [0043]; figures 3-11	1-3,5,10

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 November 2014	27/11/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Scheuer, Jürgen

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/040497

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 415 882 B1 (SCHUSTER PETER JOHN [GB] ET AL) 9 July 2002 (2002-07-09) figure 1	1

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2014/040497

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		JP H1120740 A	26-01-1999
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		US 6415882 B1	09-07-2002