October 2021

SPRING ROD TENSIONER FOR AIRBAG

TECHNICAL DISCLOSURE

SPRING ROD TENSIONER FOR AIRBAG

[0001] This disclosure relates to an inflatable apparatus for helping to protect a vehicle occupant in the event of a side impact to the vehicle and/or a vehicle rollover. More specifically, this disclosure relates to a spring rod tensioner for an airbag, such as a roof rail airbag.

Background

[0002] It is known to inflate an inflatable vehicle occupant protection device to help protect a vehicle occupant. One particular type of inflatable vehicle occupant protection device is a roof rail airbag, sometimes referred to as a curtain airbag. The curtain airbag is mounted on or adjacent the vehicle roof rail and is inflatable away from the vehicle roof between a side structure of the vehicle and a vehicle occupant. In an inflated condition, the curtain airbag can extends from adjacent the roof down to the vehicle belt line, and can cover structures such as vehicle pillars and window openings.

[0003] When installed in a vehicle, curtain airbags are stored behind vehicle interior trim pieces. During deployment, care must be exercised to ensure that the curtain airbag deploys over the trim pieces, *i.e.*, inboard of the trim pieces between the trim pieces and the vehicle occupants. Deployment ramps can be implemented in order to help direct the curtain airbag to deploy inboard of the trim pieces.

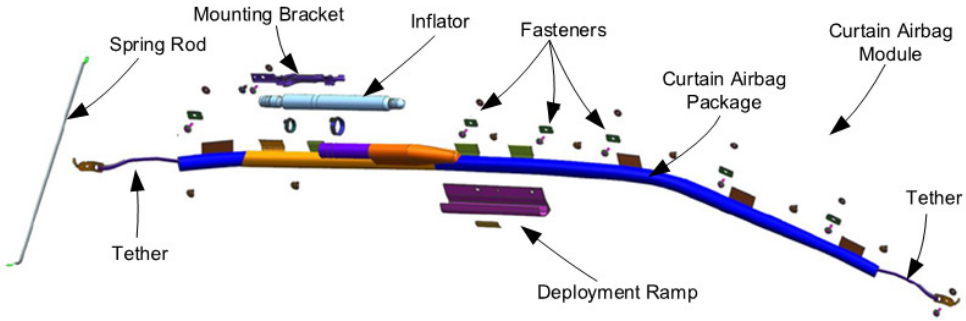
[0004] Additionally, once deployed, there is no support for the curtain airbag in the area of the window opening. It is desirable not only to provide this support, but also to tension the airbag across the window opening, from top to bottom, in order to hold the occupant inside the passenger compartment of the vehicle.

Description

[0005] A spring rod helps apply tension to a curtain airbag when deployed along a vehicle side structure and across window openings thereof. The spring rod aids in deployment by tensioning or pulling the curtain airbag into

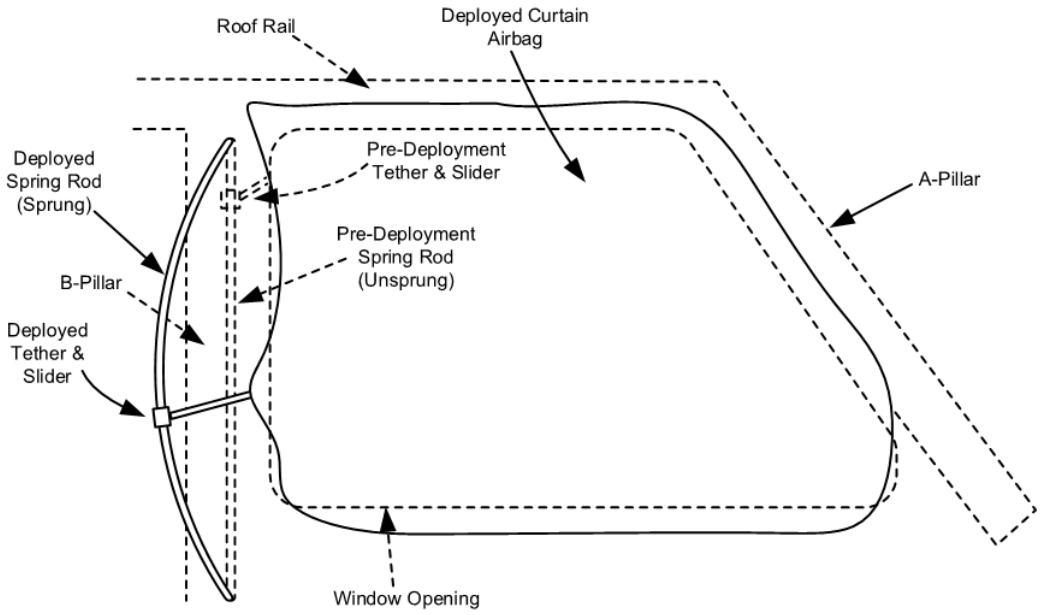
the desired position, so the airbag does not get stuck during deployment. Thereafter, the spring rod tensions the inflated and deployed curtain airbag along the side structure and across the window opening(s) and helps to maintain its position throughout the crash event. This can be especially advantageous for vehicles with large headroom and tall windows.

[0006] An example airbag module is illustrated below:



[0007] The curtain airbag package and inflator are configured to be connected to the vehicle *via* the mounting bracket and fasteners. The deployment ramp is configured to help ensure that the airbag inflates and deploys around the trim pieces of the B-pillar. The tethers connect front and rear portions of the curtain airbag to the A-pillar and C-pillar, respectively. The extent and coverage of the curtain airbag can, of course, change according to the configuration of the vehicle in which it is installed. The curtain airbag can extend between two or more vehicle pillars (A, B, C, D, *etc.*) and can cover a single window opening or multiple window openings. The curtain airbag module also includes the spring rod which, in the module configuration illustrated above, connects the rear tether to the C-pillar.

[0008] An installed configuration of the airbag module is illustrated below. In this example configuration, the curtain airbag is configured to cover a window opening of a vehicle from the A-pillar to the B-pillar, thus covering a single (front) window opening.

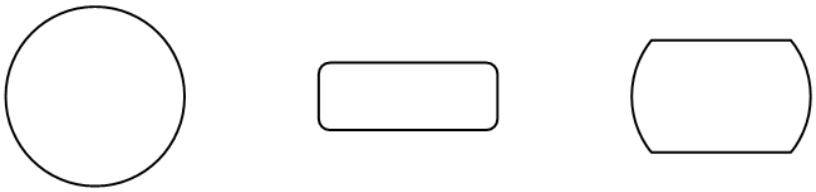


[0009] In the example configuration illustrated above, the spring rod is connected to, and extends along, the B-pillar. The curtain airbag is connected to the spring rod by a tether that is connected to a slider. The slider is configured to slide along the spring rod. The slider can be a mechanical component configured to mate with the spring rod. Alternatively, the slider can be a loop in an end of the tether. As another alternative, the slider can be omitted and the tether connected to the spring rod at a fixed location, such as at the center of curvature. As a further alternative, the slider can be held in place mechanically, and that mechanical fixation can be used to hold the spring rod in the unsprung condition. The mechanical fixation can be configured to release upon airbag deployment, *e.g.*, in response to actuation of the inflator.

[0010] The spring rod has a spring bias that causes the rod to assume a curved configuration in a sprung shown above in solid lines. In the pre-deployment configuration, illustrated in dashed lines, the spring rod is held in an unsprung, generally straight condition, as shown in dashed lines above. The spring rod is held in the pre-deployment condition by the tether and slider, which are held at or near the roof rail in the pre-deployed condition of the airbag module.

[0011] When the curtain is inflated and deployed, the airbag deploys downward toward the deployed condition illustrated above. The deploying curtain airbag pulls on the tether and slider, which causes the slider to slide downward along the spring rod. Deployment of the airbag releases the spring rod to assume the sprung condition (solid lines). Thus, as the slider slides downward with the deploying airbag, the spring rod pulls the tether and the airbag rearward as it springs toward the illustrated curved configuration. This tension applied to the curtain airbag helps ensure that the airbag deploys around trim pieces and tensions the airbag across the window opening.

[0012] The spring rod can be configured to apply a desired amount of tension force on the curtain airbag. This can be done, for example, through the configuration of the spring rod and/or the materials used to construct the spring rod. Configuring the spring rod to apply a desired amount of tension can, for example, be achieved through the cross-sectional configuration of the spring rod:



[0013] As shown above, example cross-sectional configurations of the spring rod include circular, rectangular, and round-flattened. The rectangular and flattened configurations enforce spring bending in a certain direction, orthogonal to the flats, whereas the round configuration can be bent/sprung in any direction. The flattened configurations can act in the manner of a leaf-spring.