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(54) **STRIKER APPARATUS INCLUDING A BREAKABLE STRIKER SUPPORT AND A STRAP**

(57) Aspects and embodiments of the invention provide a striker apparatus (40), a latching system (12), a tailgate system (20), a split tailgate system (14), and a vehicle (1). The striker apparatus (40) is for the latching system (12) for a closure (2, 20, 30) of the vehicle (1). The striker apparatus (40) comprises a striker assembly (40A) comprising a striker (43) and a striker support (47) configured to secure the striker (43) to a structural portion (74) of the vehicle (1), wherein the striker support comprises a mechanical fuse (47B) configured to release a detachable portion (49) of the striker assembly (40A) including the striker (43) from the structural portion (74) of the vehicle, upon application of a predetermined load. The striker apparatus (40) further comprises a strap (72) configured to tether the detachable portion (49) of the striker assembly (40A) including the striker (43) to a vehicle fixing point (70), wherein the strap is of a length to restrict opening of the closure when the mechanical fuse (47B) of the striker support breaks due to application of the predetermined load while the striker remains latched to a latch apparatus (50) of the latching system.

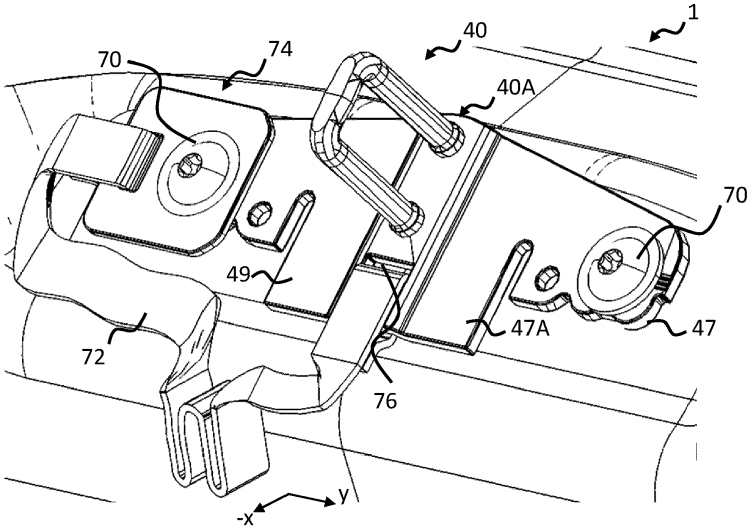

FIG. 6

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a striker apparatus, a latching system, a tailgate system, a split tailgate system, and a vehicle, the striker apparatus including a breakable striker support and a strap. In particular, but not exclusively the striker apparatus is for a vehicle tailgate or other vehicle closure.

BACKGROUND

[0002] It is desirable for a closure of a vehicle, such as a tailgate panel or side door, to remain closed when the vehicle is struck. This requires a latching system for the closure to remain latched.

[0003] In some situations, the vehicle may be struck in a manner that results in a transient force/acceleration peak through the latching system (striker apparatus and latch apparatus). If the high-g acceleration overcomes the inertia of the mechanism components within the latching system, the latching system may move in a way that de-latches the striker apparatus.

[0004] Previously, if impact tests identified a possibility of de-latching, the skilled person would reinforce the latching system to add stiffness, at the expense of added weight. Such discoveries would generally be made during physical testing, with limited freedom to re-design and re-tool components.

SUMMARY OF THE INVENTION

[0005] It is an aim of the present invention to address one or more of the disadvantages associated with the prior art.

[0006] Aspects and embodiments of the invention provide a striker apparatus, a latching system, a tailgate system, a split tailgate system, and a vehicle as claimed in the appended claims.

[0007] According to an aspect of the invention there is provided a striker apparatus for a latching system for a closure of a vehicle, wherein the striker apparatus comprises:

a striker assembly comprising a striker and a striker support configured to secure the striker to a structural portion of the vehicle, wherein the striker support comprises a mechanical fuse configured to release a detachable portion of the striker assembly including the striker from the structural portion of the vehicle, upon application of a predetermined load; and

a strap configured to tether the detachable portion of the striker assembly including the striker to a vehicle fixing point, wherein the strap is of a length to restrict opening of the closure when the mechanical fuse of the striker support breaks due to application of the predetermined load while the striker remains latched to a latch apparatus of the latching system.

[0008] It was recently surprisingly discovered by the inventors that weakening, as opposed to reinforcing, the striker apparatus can reduce the likelihood of inertial de-latching because deformation reduces peak inertial/acceleration forces within the latching system. During investigations, it was further discovered that the striker apparatus can be configured to break/tear away from its primary fixings at a predetermined load while remaining latched due to force dissipation, and the detached portion of the striker apparatus can then be tethered by a separate strap. The combination of the strap and the fact that the striker apparatus remains latched means that the closure of the vehicle is tethered and cannot fully swing open. The length of the strap dictates how far the closure can swing open, so a short strap will ensure that the closure can hardly open at all.

[0009] In some examples, the strap is a flexible fabric strap. In some examples, the strap comprises resiliently stretchable material enabling the strap to be resiliently stretched to at least 110% of a neutral unstretched length of the strap. An advantage is a further reduction of inertial/acceleration forces during the tethering phase.

[0010] In some examples, the strap has a length less than 0.6 metres such as approximately 0.3 metres. In some examples, the strap has a length short enough that when the strap is pulled taut by opening of the closure of the vehicle to which the detachable portion of the striker assembly is attached, a resulting opening through which objects can be ejected from a cabin of the vehicle has a dimension of less than or equal to 0.3 metres. An advantage is that the closure cannot swing open far enough to allow a large object to be ejected from the vehicle.

[0011] In some examples, the striker support is a striker mounting plate, and wherein the striker mounting plate comprises the mechanical fuse. Alternatively, the striker support comprises a breakable fixing, wherein the breakable fixing is configured to secure a striker mounting plate to the structural portion of the vehicle.

[0012] In some examples, the mechanical fuse of the striker support is located at a fixing point of the striker mounting plate. In some examples, a mechanical fuse of the striker support is located at each of one or more fixing points of the striker mounting plate.

[0013] In some examples, the mechanical fuse comprises one or more necks each defining a reduced cross-section area portion configured to break as a result of application of the predetermined load between the mechanical fuse and the fixing point.

[0014] In some examples, the mechanical fuse comprises a strip of the striker support separating the fixing point from an exterior edge of the striker support, wherein the strip is connected to the detachable portion of the striker support by the one or more necks, wherein the strip is arranged to break off the striker support upon fracture of the one or more necks, enabling the striker

support to shear off the fixing point.

[0015] In some examples, the striker support further comprises:

a displaceable portion to which the striker is connected; and
one or more rigid portions connected to the displaceable portion,
wherein the predetermined load at which the mechanical fuse is configured to break enables the displaceable portion to first deform relative to the one or more rigid portions. An advantage is a further reduction in peak inertial forces because there is progressive deformation of the striker support preceding the breakage of the mechanical fuse.

[0016] In some examples, the first deformation comprises out-of-plane hinge rotation of the displaceable portion relative to one or more rigid portions, and wherein the predetermined load at which the mechanical fuse is configured to break enables the out-of-plane hinge rotation of the displaceable portion to be at least 12 degrees without fracture of the striker apparatus and without breakage of the mechanical fuse.

[0017] In some examples, the striker apparatus comprises an oversized fixing aperture that is elongated in a direction to enable the striker support to slip relative to a fixing extending through the oversized fixing aperture, until collision of the mechanical fuse with the fixing. An advantage is a further reduction in peak inertial forces because there is progressive slippage of the striker support preceding the breakage of the mechanical fuse. For example, the striker support can slip and deform first, prior to the mechanical fuse breaking, to minimise overall inertial forces.

[0018] In some examples, the latching system is configured to secure a tailgate or door to the vehicle.

[0019] In some examples, the latching system is configured to secure a lower tailgate and an upper tailgate of a split tailgate system of the vehicle to one another, the closure being either the lower tailgate or the upper tailgate.

[0020] According to a further aspect of the invention there is provided a latching system comprising the striker apparatus and the latch apparatus.

[0021] According to a further aspect of the invention there is provided a tailgate system comprising the latching system or the striker apparatus.

[0022] According to a further aspect of the invention there is provided a split tailgate system comprising an upper tailgate, a lower tailgate, and the latching system. In some examples, the striker apparatus is supported by the lower tailgate and the latch apparatus is supported by the upper tailgate. Alternatively, the striker apparatus is supported by the upper tailgate and the latch apparatus is supported by the lower tailgate.

[0023] According to a further aspect of the invention there is provided a vehicle comprising the tailgate system, or the split tailgate system, or the striker apparatus, or the latching system.

[0024] Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination that falls within the scope of the appended claims. That is, all embodiments and/or features of any embodiment can be combined in any way and/or combination that falls within the scope of the appended claims, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not originally claimed in that manner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 illustrates an example of a vehicle;
FIG. 2A illustrates an example of a latching system for a vehicle closure, and FIGS. 2B and 2C illustrate examples of a latching system of a split tailgate system;
FIG. 3 illustrates an example top view of a striker apparatus;
FIG. 4 illustrates an example end view of a striker apparatus;
FIG. 5 illustrates an example deformed specimen of a striker apparatus;
FIG. 6 illustrates an example of a striker apparatus tethered to a vehicle fixing point by a strap; and
FIG. 7 illustrates an example of a striker apparatus broken off its fixing points, and restrained by a strap.

DETAILED DESCRIPTION

[0026] FIG. 1 illustrates an example of a vehicle 1 in which embodiments of the invention can be implemented. In some, but not necessarily all examples, the vehicle 1 is a passenger vehicle, also referred to as a passenger car or as an automobile. In other examples, embodiments of the invention can be implemented for other applications, such as commercial vehicles.

[0027] FIG. 1 is a front perspective view and illustrates a longitudinal x-axis between the front and rear of the vehicle 1 representing a centreline, an orthogonal lateral y-axis between left and right lateral sides of the vehicle 1, and a vertical z-axis. A forward/fore direction typically faced by a driver's seat is in the negative x-direction; rearward/aft is +x. A rightward direction as seen from the driver's seat is in the positive y-direction; leftward is -y.

These are a first lateral direction and a second lateral direction.

[0028] FIG. 2A schematically illustrates a latching system 12 for releasably connecting a closure 2 of a vehicle 1 to a structural portion 74 of the vehicle 1. The closure 2 can comprise a tailgate, a side door, or any other appropriate closure. The structural portion 74 can comprise a vehicle body of the vehicle 1 or can comprise another closure of the vehicle 1.

[0029] FIG. 2A illustrates the latching system 12 comprising a striker apparatus 40 and a latch apparatus 50. As shown in the detail view of FIG. 4, the striker apparatus 40 comprises a striker such as the illustrated loop-shaped section. Alternatively, the striker 43 can be a different shape than a loop. The striker apparatus 40 may comprise a metal such as steel.

[0030] In FIG. 2A, the latch apparatus 50 is schematically illustrated by a block that is shown attached to the striker apparatus 40. The latch apparatus 50 comprises various internal components (not visible) such as a claw configured to receive the striker 43, and a pawl configured to prevent the claw from releasing the striker 43 if the latch apparatus 50 is locked/latched.

[0031] In FIG. 2A, the latch apparatus 50 is connected to a closure 2 and the striker apparatus 40 may be connected to either the vehicle body or another closure. In an alternative implementation, the striker apparatus 40 is connected to a closure 2 and the latch apparatus 50 may be connected to either the vehicle body or another closure.

[0032] FIGS. 2B and 2C illustrate two examples of a side cross-section of a rear of a vehicle 1, showing components of a split tailgate system 14. The illustrated lower tailgate 30 is a closure that is lowerable about a lower hinge 32 to an open position. The illustrated upper tailgate 20 is a closure that is raisable about an upper hinge 22 to an open position. Therefore, the lower and upper tailgate 30, 20 are horizontally split. The lower and upper tailgates 30, 20 are shown in their closed position in which they are latched to each other.

[0033] In some, but not necessarily all examples, the split tailgate system 14 is a 'power' split tailgate system. This means that the split tailgate system 14 has one or more of the following functions:

- the lower tailgate 30 is lowerable by an actuator without user intervention to an open position;
- the lower tailgate 30 is raisable by an actuator without user intervention to a closed position;
- the upper tailgate 20 is raisable by an actuator without user intervention to an open position; or
- the upper tailgate 20 is lowerable by an actuator without user intervention to a closed position.

[0034] An actuation as described above can be requested by a user providing input to a human-machine interface. For example, the user could press a button on their key-fob or personal device (e.g. smartphone) or a button on part of the vehicle 1.

[0035] However, the striker apparatus described herein is applicable to more use cases than just a split tailgate system. In another example, the split tailgate system 14 is replaced with a non-split tailgate, having a single closure. In a further example, the closure is a non-tailgate closure such as a side door of the vehicle 1.

[0036] FIG. 2B illustrates a first example in which the lower tailgate 30 supports the striker apparatus 40 and the upper tailgate 20 supports the latch apparatus 50. For example, the striker apparatus 40 can be secured to the lower tailgate 30 by bolts, screws or other fixings. The latch apparatus 50 can be secured to the upper tailgate 20 in a similar way.

[0037] FIG. 2C illustrates a second example in which the striker apparatus 40 and the latch apparatus 50 are swapped around. The upper tailgate 20, rather than the lower tailgate 30, supports the striker apparatus 40, and the lower tailgate 30 supports the latch apparatus 50.

[0038] FIGS. 2B-2C also illustrate an external body 60 approaching the lower tailgate 30 from behind the vehicle 1. When the illustrated external body impacts the lower tailgate 30, the impact contact point between the external body 60 and the vehicle 1 is below a split line between the lower and upper tailgates 30, 20. The impact contact point is therefore localised to only the lower tailgate 30 but not the upper tailgate 20. The lower tailgate 30 will be translated in a vehicle-inboard direction 62 (illustrated -ve x-axis, towards the front of the vehicle 1). This will cause a transient force through the striker apparatus 40 and the latch apparatus 50.

[0039] FIGS. 3-7 illustrate an example design of the striker apparatus 40.

[0040] As shown in the combination of FIGS. 3 and 6, the striker apparatus 40 comprises a striker assembly 40A, the striker assembly 40A comprising a striker 43 and a striker support 47, such as a striker mounting plate 47A, configured to secure the striker 43 to a structural portion 74 (e.g., vehicle body or tailgate closure) of the vehicle 1.

[0041] FIG. 3 and 6 show the striker 43 secured (e.g., welded) to a striker mounting plate 47A approximately centrally between lateral ends of the striker mounting plate 47A. The illustrated y-axis extends between the lateral ends. The illustrated striker mounting plate 47A is elongated in the y-axis (width/lateral dimension), and short in the x-axis (length dimension) due to the limited thickness of the lower tailgate 30 (or upper tailgate 20).

[0042] The width of the striker mounting plate 47A can be a value from the range 10cm to 30cm. The length of the striker mounting plate 47A can be less than 10cm. The thickness of the striker mounting plate 47A can be a value from the range approximately 3mm to approximately 8mm. In an example, the thickness is approximately 4mm.

[0043] The striker mounting plate 47A is a structural layer of material with a high Youngs Modulus and low brittleness, such as steel or a similar metallic material.

An example steel is high strength steel or a higher grade, with a yield of 600MPa or higher.

[0044] The illustrated striker 43 is a loop (FIG. 4), riveted or welded to the striker mounting plate 47A at both ends of the striker 43.

[0045] The striker 43 can be oriented perpendicular to the y-axis such that the loop is visible from an end view looking along the y-axis (FIG. 4).

[0046] The striker mounting plate 47A can comprise fixing portions 46 configured to enable the striker mounting plate 47A to be secured to the lower tailgate 30 (or upper tailgate 20). In this example, the fixing portions 46 comprise fixing apertures for separate fixings 70 such as screws. In other examples, the fixings are integral.

[0047] In FIG. 3, a fixing portion 46 is located to each lateral side of the striker 43. The fixing portions 46 are located proximal to the lateral ends of the striker mounting plate 47A.

[0048] The striker mounting plate 47A and its fixing apertures can be symmetric about the striker 43 (x-axis).

[0049] Overall, the striker assembly 40A can be configured to withstand, without fracture, a static tension force through the striker 43 of at least 14kN (static pull test), wholly in the z-axis. This is achieved by configuration of the material and the geometry.

[0050] FIGS. 3-7 illustrate an example design of the striker apparatus 40, optimised to reduce the likelihood of de-latching as a result of inertial and deformation forces resulting from the type of translation described above.

[0051] Counterintuitively, the striker support 47, such as the striker mounting plate 47A, is breakable and includes a mechanical fuse 47B. When the mechanical fuse 47B of the striker support 47 breaks at a predetermined load, in the order of approximately 10^1kN, a detachable portion 49 of the striker assembly 40A is released from the structural portion 74 of the vehicle 1. This is schematically illustrated in FIG. 7. The detachable portion 49 remains attached to the striker 43 which is secured to the latch apparatus 50, however, they are no longer secured to the structural portion 74 of the vehicle 1. Therefore, the closures 20, 30 are able to start opening due to inertial forces from the impact. However, before the closures 20, 30 open significantly, a strap 72 illustrated in FIGS. 6 and 7 catches the detached detachable portion 49 of the striker assembly 40A to 'tether' the detachable portion 49, therefore preventing further opening of the closures 20, 30. The illustrated strap 72 is connected at one end to a strap attachment point 76 of the detachable portion 49 of the striker assembly 40A, and at the other end to a vehicle fixing point such as a fixing 70 anchored to the vehicle body. In other examples, the strap 72 can be connected to a different vehicle body location.

[0052] An advantage of the mechanical fuse 47B is that its failure reduces the peak force/acceleration through the striker apparatus 40 and the latch apparatus 50. This helps the striker 43 to remain latched in an impact, which is a preferable situation compared to de-latching because all that is needed to prevent the closures 20, 30 from opening is a secondary backup connection such as the strap 72. Without the mechanical fuse 47B, de-latching may occur which will allow the closures 20, 30 to fully open.

[0053] In FIGS. 3, 6 and 7, but not necessarily all examples, the striker support 47 is the striker mounting plate 47A (structural plate) comprising mechanical fuses 47B at each fixing portion 46.

[0054] Each illustrated mechanical fuse 47B comprises a narrow strip of the striker mounting plate 47A. Optionally, the strip may be straight as shown. The mechanical fuse 47B is a narrow perimeter portion of a fixing portion 46 (e.g., fixing aperture) closest to an exterior edge 400 of the striker mounting plate 47A. The strip may comprise one or more necks 402 of reduced cross-section, connecting the strip to the rest of the striker mounting plate 47A.

[0055] Once the necks 402 of the mechanical fuse 47B break at the predetermined load, the detachable portion 49 of the striker mounting plate 47A can slip out of engagement with the fixing 70. In this example, a 'detachable portion 49' refers to substantially the whole striker mounting plate 47A which is detached from the fixing 70. The strap 72 will then 'take over' and tether the detachable portion 49 to a vehicle fixing point to which the strap 72 is attached, to prevent further opening of the closures 20, 30.

[0056] In a different implementation than that shown in the FIGs, the striker mounting plate 47A is not breakable, and instead the fixing 70 may be breakable such as a breakable bolt. A fixing 70 falls within the meaning of the claimed term 'striker support' since it supports the striker 43. In a still further alternative implementation, both the fixing 70 and the striker mounting plate 47A are breakable.

[0057] The mechanical fuse 47B comprises one or more necks 402 defining a reduce cross-section area portion. A neck 402 is defined as a weak-point to break as a result of application of a predetermined load. The predetermined load may be determined from impact tests and/or simulations. Additionally, or alternatively to a geometric weak-point, the intrinsic material properties (e.g., Modulus) of the mechanical fuse may be different from that of the rest of the striker support, to enable the breaking at the predetermined load.

[0058] FIGS. 3 and 6 represent one of several possible ways of implementing a mechanical fuse 47B at a perimeter of a fixing portion 46 of a striker mounting plate 47A. In this example, the fixing portion 46 is a fixing aperture comprising lobes 46A, 46B extending towards an exterior edge 400 of the striker mounting plate 47A. Each lobe 46A, 46B creates a neck 402 between the lobe 46A, 46B and the exterior edge 400 of the striker mounting plate 47A, defining a weak-point where the cross-section of the striker mounting plate 47A is narrowest (distance from lobe to exterior edge 400).

[0059] When each neck 402 breaks due to impact load

from the fixing portion 46 to the fixing 70, a narrow strip of the striker mounting plate 47A between the lobes 46A, 46B detaches from the striker mounting plate 47A due to failure of each neck 402 at the ends of the strip (the strip referred to herein as the mechanical fuse 47B). The fixing portion 46 can now shear off the fixing 70 because the fixing 70 is no longer enclosed. FIG. 7 shows that the removal of the mechanical fuses 47B has converted the fixing portions 46 (fixing apertures) from enclosed apertures to open apertures, which are open at the exterior edge 400 of the striker mounting plate 47A. The fixings 70 can therefore slip out of the open apertures.

[0060] The mechanical fuses 47B may be to the vehicle inboard side of the fixing portions 46, for the embodiment shown in FIG. 2B. However, for the embodiment shown in FIG. 2C, the mechanical fuses 47B may be to the vehicle outboard side of the fixing portions 46, because the striker mounting plate 47A may be facing the opposite direction. Either way, the force through the latch apparatus 50 pulling the striker mounting plate 47A out of the open apertures is the same as the direction of the force that then pulls the strap 72 taut.

[0061] A neck 402 can be defined as a portion of material having a reduced cross-sectional area so as to fracture at the predetermined load. The necks 402 have an even smaller cross-sectional areas than the strip of material forming the main body of the mechanical fuse 47B. In some examples, a neck 402 can be defined as a portion of material having the smallest cross-sectional area of any part of the whole striker mounting plate 47A.

[0062] In FIG. 3, the ends of the strips of material defining the mechanical fuses 47B comprise such necks 402. The illustrated necks 402 are the narrowest sections of any part of the whole striker mounting plate 47A. FIG. 7 shows the striker mounting plate 47A in a broken condition wherein the mechanical fuses 47B have detached at the necks 402 and are therefore missing in FIG. 7. The striker mounting plate 47A has broken into several parts and can therefore be defined as a frangible structure because parts break off the plate 47A.

[0063] In FIG. 7, fractures extend from each lobe 46A, 46B to the nearest exterior edge 400 of the striker mounting plate 47A, indicating where the mechanical fuses 47B have broken off from the striker mounting plate 47A. The fractures were caused by the shear force between the fixings 70 and the mechanical fuses 47B.

[0064] Alternative ways of creating the mechanical fuse 47B, instead of using lobes 46A, 46B, include locating the fixing portion 46 closer to the exterior edge 400 of the striker mounting plate 47A, or replacing the lobes 46A, 46B with a different shape of aperture formation extending from the fixing portion 46, or locally decreasing the thickness of the striker mounting plate 47A. There are many possible further implementations. A further alternative implementation involves the mechanical fuse 47B being at a separate position of the striker assembly 40A than at a fixing portion 46. The specific implementation is not critical. The end result is that the mechanical fuse 47B may be the weakest point of the striker support 47, taking into account geometry and/or intrinsic material properties, and that the detachable portion 49 of the striker mounting plate 47A detaches from the fixings 70.

[0065] FIG. 6 illustrates the strap 72 in more detail. As illustrated, the strap 72 may be a flexible fabric strap. The strap 72 may be a webbing strap. The use of a fabric strap is advantageous for several reasons. Firstly, a fabric strap 72 can resiliently stretch elastically by a controlled amount, to dissipate energy and minimise peak acceleration through the latch apparatus 50. The fabric strap 72 comprises resiliently stretchable material enabling the strap 72 to be resiliently stretched to at least, for example, 110% of a neutral unstretched length of the strap 72, without strap breakage.

[0066] The degree of stretch is readily configurable via thread selection and/or warp/weft counts. A further advantage of a fabric strap 72 is that the material properties and/or warp/weft count of the strap 72 can be readily reconfigured for different vehicle model variants requiring different strap strengths. Further, a fabric strap 72 is lightweight and is not sensitive to the direction of the impact.

[0067] The thread material of the fabric strap 72 may comprise glass fibre, carbon fibre, nylon, or any other appropriate material.

[0068] The required length of the strap 72 depends on how far the vehicle fixing point for one end of the strap 72 is located from the strap attachment point 76 of the detachable portion 49 for receiving the other end of the strap 72. The required length of the strap 72 further depends on how far the closures 20, 30 should be allowed to open before the strap 72 becomes tensioned. In the illustrated example, the vehicle fixing point for the strap 72 is the same fixing 70 that secures the striker assembly to the structural portion 74 of the vehicle, therefore, the strap 72 does not need to be long. Depending on implementation, a strap length of no more than approximately 0.6 metres is therefore appropriate. In an example implementation, the strap length is approximately 0.3 metres. The strap 72 has a length short enough that when the strap 72 is pulled taut by opening of the closure 20 or 30 of the vehicle 1 to which the detachable portion 49 of the striker assembly 40A is attached, a resulting opening through which objects can be ejected from a cabin of the vehicle 1 has a dimension of less than or equal to 0.3 metres.

[0069] According to some, but not necessarily all examples of the disclosure, the mechanical fuse(s) and strap 72 are not the only optimisation of the striker assembly 40A to reduce peak force/acceleration through the latch apparatus 50.

[0070] One further optimisation comprises configuring one or more of the fixing portions 46 to be oversized relative to its fixing 70. The fixing portion 46 is oversized such that the fixing portion 46 can slip (shears) relative to the fixing 70 before the mechanical fuse 47B hits the fixing 70 and breaks. The slippage dissipates energy. The fixing portions 46 are oversized (e.g., elongated) in

a direction that causes the mechanical fuses 47B of the slipping striker mounting plate 47A to slip and then collide with the static fixings 70. Upon this collision, mechanical stress is imparted on the necks 402 of the mechanical fuses 47B. The necks 402 break if the load reaches the predetermined value. If the necks 402 break, the fixing portions 46 are now open apertures due to the removal of the mechanical fuses 47B. Therefore, the striker mounting plate 47A can continue to slip in the same direction to be released from the fixings 70.

[0071] Another optimisation comprises configuring the striker mounting plate 47A to have variable deformability between its lateral ends, to enable the striker mounting plate 47A to first plastically deform before the mechanical fuse 47B breaks. FIG. 5 shows an example of the plastic deformation of a specimen striker mounting plate 47A. As shown in FIGS. 3 and 5, the plastic deformation is enabled by configuring the striker mounting plate 47A to include a displaceable portion 41 to which the striker is connected. The illustrated displaceable portion 41 is a central portion of the striker mounting plate 47A, connected to a pair of lateral, rigid portions 42 of the same striker mounting plate 47A via deformable portions 44.

[0072] A deformable portion 44 is located between each fixing portion 46 and the central, displaceable portion 41 to which the striker 43 is connected. In use, stress is concentrated at the deformable portions 44, making local plastic deformation at the deformable portion more likely in the event of an impact.

[0073] By encouraging a portion of the striker mounting plate 47A to deform when the forces are significantly higher than those for opening/closing the tailgate, the central, displaceable portion 41 to which the striker 43 is connected can displace significantly. This enables the striker 43 to be pulled/rotated in a configured direction to reduce acceleration at the latch apparatus 50. In FIG. 5, the striker 43 has been rotated about the y-axis without tearing of the striker mounting plate 47A. In the test, the striker 43 remained latched. Therefore, the peak acceleration was low enough not to overcome the inertia of latching mechanism components and therefore did not cause unintended actuation of the latching mechanism components.

[0074] Measured g-forces at the striker assembly 40A were around 150g, significantly better than the 250g encountered in a version without deformable portions 44.

[0075] The displacement was rotational because of torque about the fixing portions 46. There is torque due to lever arms in the x, y and z axes between the top of the striker 43 and the fixing portions 46. Further, the direction of force may be dynamic during the event.

[0076] In the illustrated example, each deformable portion is a reduced cross-section portion 44, comprising a local narrowing of the striker mounting plate 47A to concentrate stress. Alternatively, or additionally, each reduced cross-section portion 44 can comprise a local thinning (z-axis) of the striker mounting plate 47A.

[0077] The reduced cross-section portions 44 can be created by drilling or moulding channels into the striker mounting plate 47A. In the illustrations, each channel is a slot 45 (elongated through-hole). The illustrated slots 45 are open at a common side of the striker mounting plate 47A. The slots 45 may be open at the same side of the striker mounting plate 47A as the above-mentioned exterior edge 400. The slots 45 may be straight and/or parallel to each other. The slots 45 may be to either side of the striker 43. At the end of each slot 45 is a narrow bridge 48 of material connecting the central, displaceable portion 41 (to which the striker 43 is connected) to a rigid portion 42 where the fixing portion 46 is located. Each bridge 48 demarcates the central, displaceable portion 41 from a corresponding lateral, rigid portion 42. The slots

[0078] In view of the foregoing, the striker mounting plate 47A can be regarded as having a plurality of portions:

- the central, displaceable portion 41 to which the striker 43 is connected;
- a deformable, reduced cross-section portion 44 (e.g. slotted portion) to each lateral side of the central, displaceable portion 41, configured to deform to enable the central, displaceable portion 41 to displace; and
- a rigid portion 42 towards each lateral end, each comprising a fixing portion 46.

[0079] The experimental result of FIG. 5 illustrates that the central displaceable portion 41 has rotated out-of-plane relative to the previously approximately flat plane of the striker mounting plate 47A (flat notwithstanding a small hump at the central, displaceable portion 41). The rotation is about the y-axis. Most of the deformation occurred at the bridges 48 of the deformable, reduced cross-section portions 44, as evidenced by the nonzero angle α between one edge of the slot 45 and the other parallel edge of the slot 45. In FIG. 5, α is approximately 18.5 degrees and neither fracture nor de-latching occurred. Before the test, α was approximately 0 degrees. The striker mounting plate 47A can be configured to enable the angle α to be at least 12 degrees without fracture of the striker mounting plate 47A, and prior to breakage of the mechanical fuse 47B.

[0080] In FIG. 5, a small amount of further deformation occurred at the rigid portion 42 and the central displaceable portion 41, as they are not infinitely rigid. They are visibly deformed slightly out of a flat plane. There is no visible deformation of the striker 43 itself. This further deformation further contributes to the reduction of force/acceleration through the striker 43.

[0081] Based on FIG. 5, the bridges 48 of the deformable, reduced cross-section portions 44 can be regarded as hinge formations that enable the central displaceable portion 41 to rotate by at least the angle α without fracture. They are plastically deformable hinges.

[0082] The predetermined load at which the mechanical fuses 47B are configured to break enables the cen-

tral, displaceable portion 41 to first deform relative to the one or more rigid portions 42. In addition, the fixing portions 46 may be oversized apertures enabling slippage of the striker mounting plate 47A prior to breakage of the mechanical fuses 47B. Therefore, the striker apparatus 40 reduces inertial forces in a progressive manner: first there is deformation and/or slippage, and only then is there breakage and tethering. The overall inertial forces are minimal.

[0083] It will be appreciated that various changes and modifications can be made to the present invention without departing from the scope of the present application.

[0084] Although embodiments of the present invention have been described in the preceding paragraphs with reference to various examples, it should be appreciated that modifications to the examples given can be made without departing from the scope of the invention as claimed.

[0085] Features described in the preceding description may be used in combinations other than the combinations explicitly described.

[0086] Although functions have been described with reference to certain features, those functions may be performable by other features whether described or not.

[0087] Although features have been described with reference to certain embodiments, those features may also be present in other embodiments whether described or not.

[0088] Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

Claims

1. A striker apparatus for a latching system for a closure of a vehicle, wherein the striker apparatus comprises:

   a striker assembly comprising a striker and a striker support configured to secure the striker to a structural portion of the vehicle, wherein the striker support comprises a mechanical fuse configured to release a detachable portion of the striker assembly including the striker from the structural portion of the vehicle, upon application of a predetermined load; and

   a strap configured to tether the detachable portion of the striker assembly including the striker to a vehicle fixing point, wherein the strap is of a length to restrict opening of the closure when the mechanical fuse of the striker support breaks due to application of the predetermined load while the striker remains latched to a latch apparatus of the latching system.

2. The striker apparatus of claim 1, wherein the strap is a flexible fabric strap.

3. The striker apparatus of claim 1 or 2, wherein the strap comprises resiliently stretchable material enabling the strap to be resiliently stretched to at least 110% of a neutral unstretched length of the strap.

4. The striker apparatus of claim 1, 2 or 3, wherein the strap has a length short enough that when the strap is pulled taut by opening of the closure of the vehicle to which the detachable portion of the striker assembly is attached, a resulting opening through which objects can be ejected from a cabin of the vehicle has a dimension of less than or equal to 0.3 metres.

5. The striker apparatus of any preceding claim, wherein the striker support is a striker mounting plate, and wherein the striker mounting plate comprises the mechanical fuse.

6. The striker apparatus of any preceding claim, wherein the mechanical fuse of the striker support is located at a fixing point of the striker support.

7. The striker apparatus of claim 6, wherein the mechanical fuse comprises one or more necks each defining a reduced cross-section area portion configured to break as a result of application of the predetermined load between the mechanical fuse and the fixing point.

8. The striker apparatus of claim 7, wherein the mechanical fuse comprises a strip of the striker support separating the fixing point from an exterior edge of the striker support, wherein the strip is connected to the detachable portion of the striker support by the one or more necks, wherein the strip is arranged to break off the striker support upon fracture of the one or more necks, enabling the striker support to shear off the fixing point.

9. The striker apparatus of any preceding claim, comprising an oversized fixing aperture that is elongated in a direction to enable the striker support to slip relative to a fixing extending through the oversized fixing aperture, until collision of the mechanical fuse with the fixing.

10. The striker apparatus of any preceding claim, wherein the latching system is configured to secure a tailgate or door to the vehicle.

11. The striker apparatus of claim 10, wherein the latching system is configured to secure a lower tailgate and an upper tailgate of a split tailgate system of the

vehicle to one another, the closure being either the lower tailgate or the upper tailgate.

12. A latching system comprising the striker apparatus of any preceding claim and the latch apparatus.

13. A tailgate system comprising the latching system of claim 12 or the striker apparatus of any one of claims 1 to 11.

14. A split tailgate system comprising an upper tailgate, a lower tailgate, and the latching system of claim 12 as dependent on claim 11.

15. A vehicle comprising the tailgate system of claim 13, or the split tailgate system of claim 14, or the striker apparatus of any one of claims 1 to 11, or the latching system of claim 12.

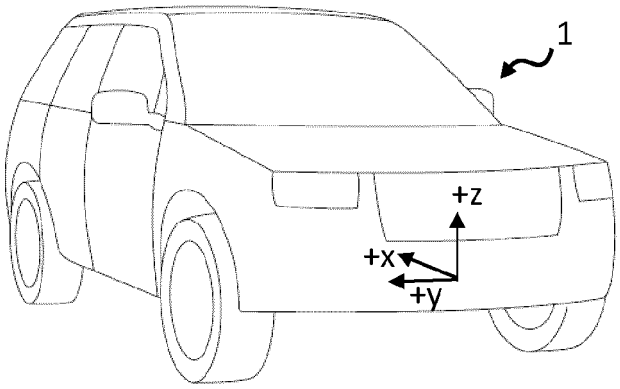


FIG. 1

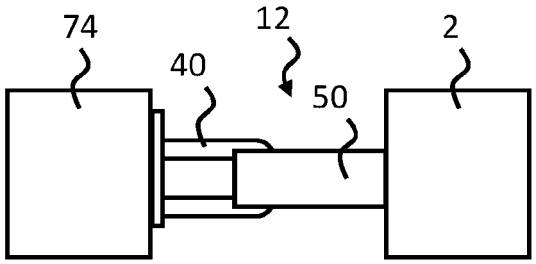


FIG. 2A

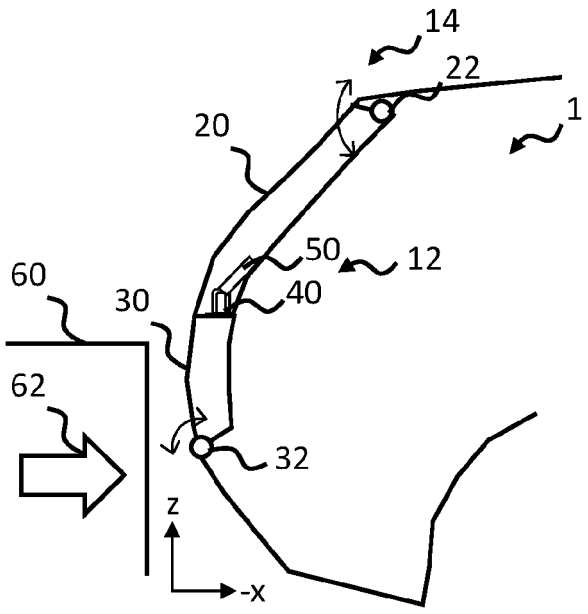


FIG. 2B

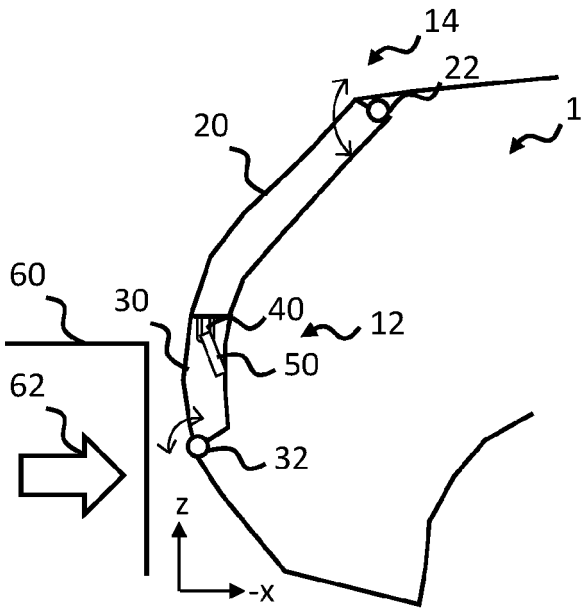
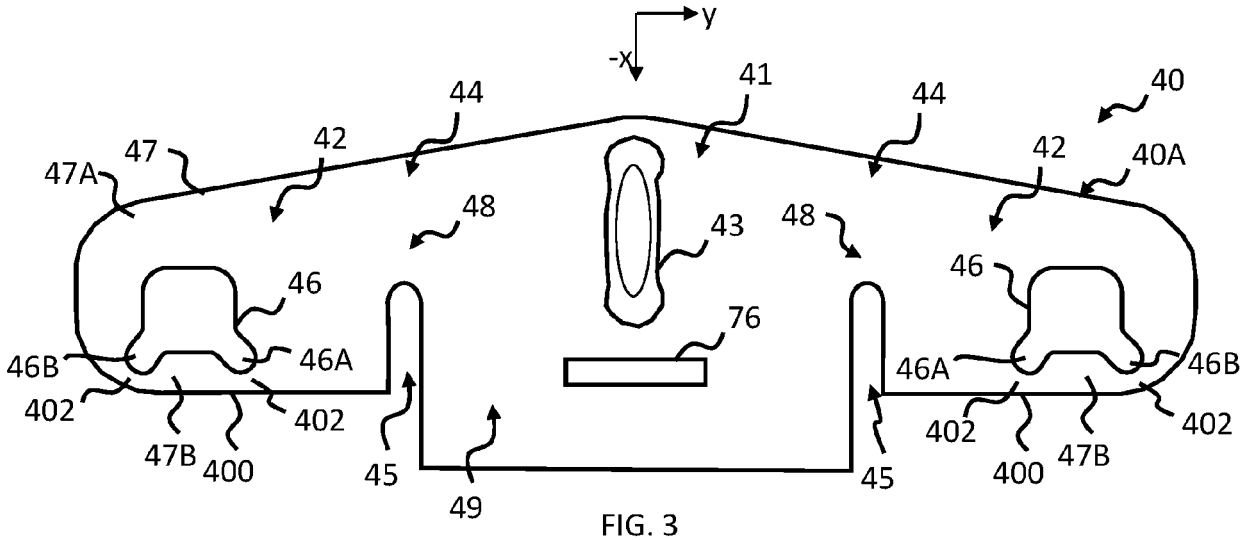


FIG. 2C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47B
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FIG. 3

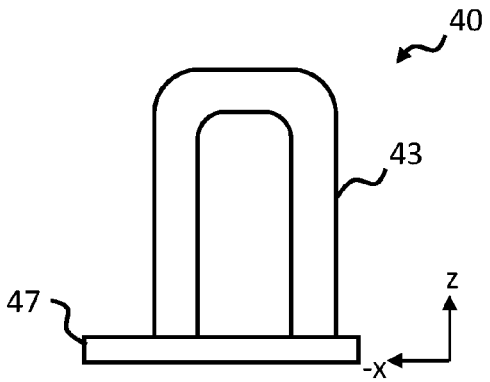
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FIG. 4

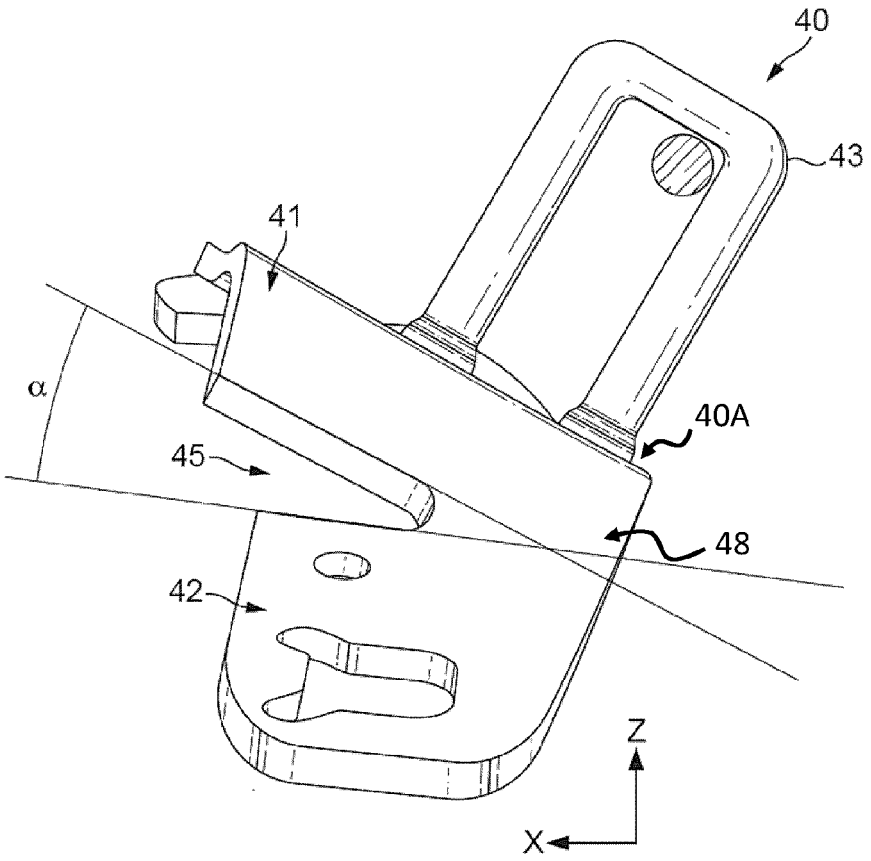

FIG. 5

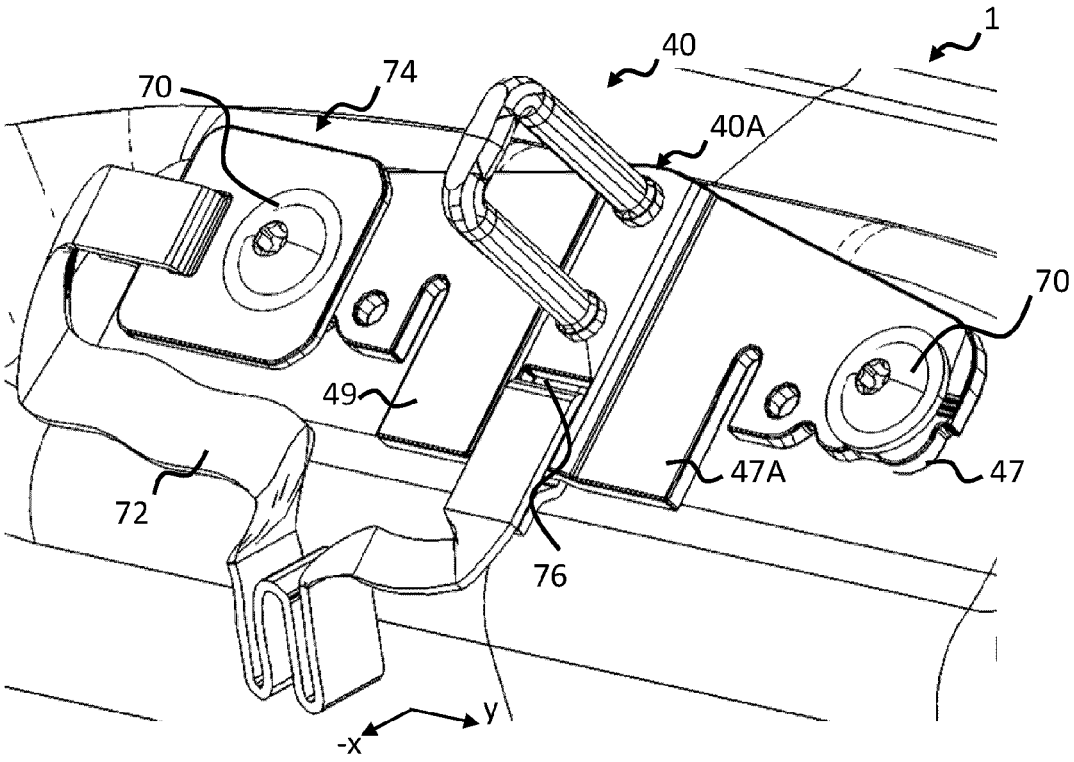

FIG. 6

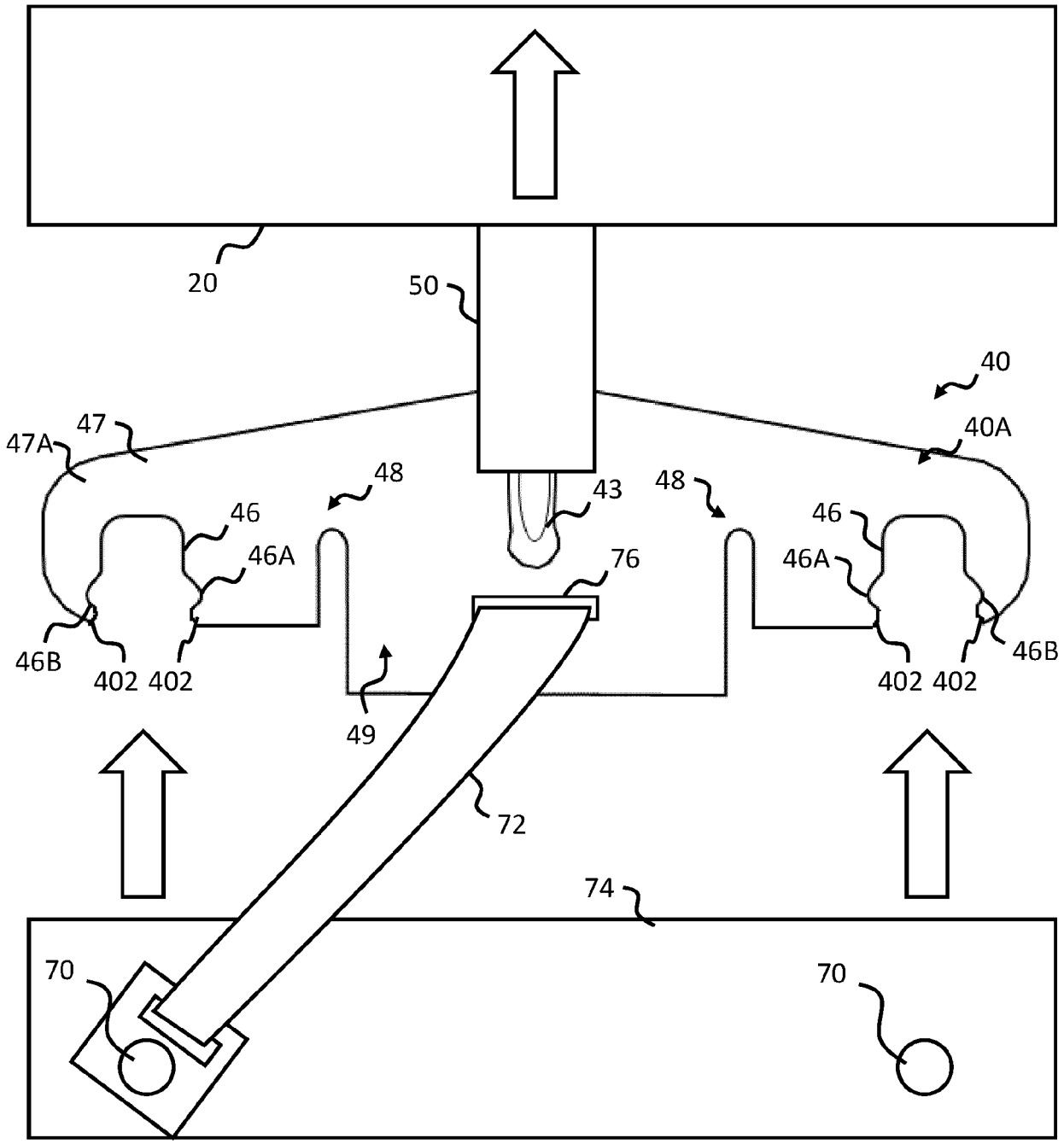
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FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 0714

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	DE 10 2011 122048 A1 (DAIMLER AG) 27 June 2013 (2013-06-27)	1,4-8, 10-15	INV. E05B15/02 E05B77/10 E05B17/00
A	* paragraph [0038]; figures 4-5 *	2,3	
A	JP 2006 063622 A (NISSAN MOTOR) 9 March 2006 (2006-03-09) * the whole document *	1-15	E05B85/04

TECHNICAL FIELDS SEARCHED (IPC)

E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 September 2023	Van Beurden, Jason

CATEGORY OF CITED DOCUMENTS

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21-09-2023

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