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(54) **Title**: METHOD AND VEHICLE SEAT ARRANGEMENT COMPRISING A DEFORMATION PORTION

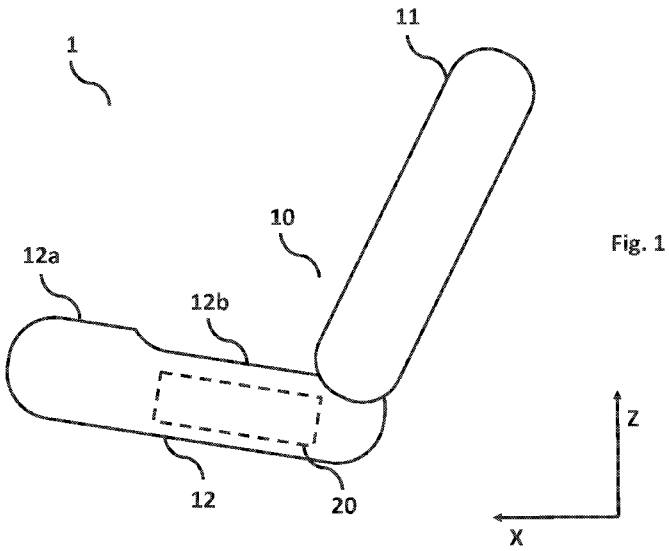

Fig. 1

(57) **Abstract**: A vehicle seat arrangement (1) in a vehicle is disclosed. The vehicle seat arrangement (1) comprises a vehicle seat (10) with a back portion (11) and a seat portion (12), said seat portion (12) comprises a front section (12a), adapted to support legs and knees of a user, and a rear section (12b) adapted to support the user's weight. The rear section (12b) of the vehicle seat (10) comprises a deformation unit (20) adapted to reduce the force exerted on the user during a crash, the force being absorbed through plastic deformation of a deformation portion (22). The deformation portion (22) is adapted to deform with a linear deformation property of the energy absorption, after a force threshold is exceeded. A method used in said vehicle seat arrangement (1) is also disclosed.

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METHOD AND VEHICLE SEAT ARRANGEMENT COMPRISING A DEFORMATION PORTION

Technical field

[0001] The present invention relates generally to a vehicle seat arrangement for enhancing passenger safety.

Background art

[0002] In prior art it is known to provide solutions for enhancing the passenger safety during vehicle accidents. The vehicle interior handles most of the contact with the driver and passengers during an accident and serves a crucial role for protecting the individuals within the vehicle's passenger compartment during an accident. Solutions for protecting passengers in a vehicle passenger compartment are available in prior art and comprises airbags, seatbelts, padded surfaces, and many other protective solutions.

[0003] Prior art further more presents solutions hidden from the vehicle user that serves a crucial role for protecting the passengers of the vehicle during a collision, accident, or crash. The present invention relates to an enhancement and improvement of vehicle seats wherein the safety is enhanced for the person sitting in the vehicle seat during a crash, collision, or accident. Vehicle seats of the prior art are padded and comprises features for decreasing the risk for injuries such as whiplash protection and airbags mounted in the vehicle seat. However, most features except for the padding of vehicle seats are adapted to assist during front collisions, or forces excreted in the longitudinal direction of the vehicle. There are safety issues for crashes wherein a vertical force on a driver or passengers spine that are not sufficiently addressed by the prior art.

[0004] Therefore, it would be beneficial to create a vehicle seat that provides additional safety features and further decreases the risk of injury to drivers and passengers of vehicles.

Summary of invention

[0005] Prior art solution further comprises solutions for deforming the structure supporting the passenger or drivers weight in order to decrease the forces exerted mainly on the passenger's spine during a collision. The solutions as presented in prior art comprises deformation through compressing sheet metal, much like the deformation to the front of a vehicle during a front collision, in order to absorb the force. This has the effect that the force is absorbed in an uneven and not linear procedure making the energy absorption less effective.

[0006] The uneven energy absorption furthermore generates spikes of G-force that affects the vehicle user and thereby creating a situation where the vehicle user is subjected to unhealthy high levels of G-forces.

[0007] An object of the present invention is to decrease the risk of spinal injuries during lane departure and similar accidents wherein the vehicle ends up at a level lower than the street level, for example in a ditch.

[0008] Another object of the present invention is to decrease the G-forces exerted on the human body during vehicle accidents.

[0009] Yet another object of the present invention is to create a constant force absorption decreasing the fluctuation in the absorption capability of the structure.

[0010] Yet another object is to absorb forces exerted in a Z-direction during a collision, lane departure accident, or similar.

[0011] Thus, the solution relates to a vehicle seat arrangement in a vehicle. The vehicle seat arrangement comprises a vehicle seat with a back portion and a seat portion, said seat portion comprises a front section, adapted to support legs and knees of a user, and a rear section adapted to support the user's weight. The rear section of the vehicle seat comprises a deformation unit adapted to reduce the force exerted on the user during a crash, the force being absorbed through plastic deformation of a deformation portion. The deformation portion is adapted to deform with a linear deformation property after a force threshold is exceeded.

[0012] It is one advantage with the present solution that the deformation portion of the deformation unit deforms with a linear deformation property. This means that the deformation absorbs the same amount of energy during the deformation making the fluctuations as low as possible. This has the advantage that more energy is absorbed, less G-forces are subjected to the spine of the vehicle user, and the system works equally well independent of the weight of the user. This means that the force exerted on the spine during a lane departure and other situations when the vehicle ends up in a ditch or similar at a lower level than the street is significantly reduced.

[0013] It is further one advantage with the present solution that the deformation unit is arranged in the rear section of the vehicle seat. The reason for this is that the user sitting in the seat has a weight center in the rear section of the vehicle seat.

[0014] The force that the solution aims to minimize is a force in a negative Z-direction, i.e. in a direction downwards relation to the travel direction of a vehicle. Forces in the Z-direction can put large stress on the spine of vehicle users.

[0015] According to an embodiment of the vehicle seat arrangement the deformation unit further comprises an attachment portion that during deformation moves in a direction that deforms the deformation portion.

[0016] It is one advantage with the present solution that the deformation unit is arranged to absorb forces in the Z-direction and that the force is absorbed mainly through increasing the length of the deformation unit in an X-direction.

[0017] According to an embodiment of the vehicle seat arrangement said vehicle seat further comprises a support carpet.

[0018] The support carpet is the part of a vehicle seat that supports the weight of the user in the seat portion. The support carpet can in different embodiments have different designs, such as a carpet, a thread structure, and a spring structure.

[0019] According to an embodiment of the vehicle seat arrangement the deformation unit and deformation portion thereof is rigid during normal driving conditions and only deforms in the event of a crash when a predetermined force threshold is exceeded.

[0020] According to an embodiment of the vehicle seat arrangement the attachment portion is adapted to progressively tear the deformation portion after the force threshold has been exceeded.

[0021] The problem with many of the prior art solutions is that they utilize technology that wrinkles or in other way deforms sheet metal unevenly meaning that the force absorption also becomes uneven. By progressively tear the deformation portion the force absorption is constant and the performance of the solution improved.

[0022] According to an embodiment of the vehicle seat arrangement the attachment portion is arranged as a part of the support carpet.

[0023] It is one advantage with the present solution that the length of the support carpet can be increased by moving the attachment portions and thereby extending the length of the deformation unit.

[0024] According to an embodiment of the vehicle seat arrangement the support carpet is a support carpet with a thread structure.

[0025] In another embodiment is the support carpet of a fiber, spring, or fabric structure.

[0026] According to an embodiment of the vehicle seat arrangement the attachment portion is a socket adapted to be dragged through a pipe structure with resistance when the force threshold is exceeded.

[0027] The solution in accordance with the appended claims can be produced in accordance with many different embodiments. According to one embodiment is a socket adapted to be dragged through a pipe structure. This solves the same technical problem in the same way as the other embodiments herein.

[0028] According to an embodiment of the vehicle seat arrangement the pipe structure has an elongated weakening allowing the pipe structure to deform when the socket is dragged through the pipe structure.

[0029] According to an embodiment of the vehicle seat arrangement the attachment portion is arranged in an aperture in the deformation portion which is smaller than the attachment portion, the attachment portion is adapted to deform the deformation portion by folding its edges making the aperture an elongated aperture of a substantially equal width, the width being substantially the same as the width of the attachment portion.

[0030] According to an embodiment is the aperture in the substantial form of a key hole.

[0031] According to an embodiment of the vehicle seat arrangement the deformation unit is a bracket comprising a deformation portion arranged to limit the length of the support carpet.

[0032] One embodiment in accordance with the appended claims is a solution wherein a bracket is arranged in order to limit the length of the support carpet. The bracket is a deformation unit and adapted to restore the support carpet to its full length if the force exceeds the predetermined threshold value. In one embodiment is the deformation unit made of a polymer material.

[0033] According to an embodiment of the vehicle seat arrangement the upholstery of the vehicle seat is released when the force threshold is exceeded.

[0034] In addition to increasing the length of the support carpet it is in one embodiment important to enable that the upholstery of the vehicle seat can be released in order to not limit the expanding length of the support carpet and deformation unit.

[0035] The deformation unit is arranged as part of the support carpet and enables that the support carpets arranged length is increased. The person skilled in the art understands that in some embodiments is the length increased through

deformation, in others is the length already present but retained until the force threshold is breached.

[0036] According to an aspect for a vehicle seat arrangement arranged in a vehicle, the vehicle seat arrangement comprises a vehicle seat with a back portion and a seat portion, said seat portion comprises a front section, adapted to support legs and knees of a user, and a rear section adapted to support the user's weight. The rear section of the vehicle seat comprises a deformation unit adapted to reduce the force exerted on the user during a crash, the force being absorbed through plastic deformation of a deformation portion, and
- when a certain force threshold is exceeded,
- deforming the deformation portion with a linear deformation property.

[0037] According to an embodiment the deformation unit further comprises an attachment portion that during deformation is moving in a direction that deforms the deformation portion.

Brief description of drawings

[0038] The invention is now described, by way of example, with reference to the accompanying drawings, in which:

[0039] Fig. 1 illustrates one embodiment of the vehicle seat arrangement comprising a vehicle seat, back portion, and a deformation unit.

[0040] Fig. 2a illustrates a prior art solution.

[0041] Fig. 2b illustrates a prior art solution wherein an uneven deformation has occurred.

[0042] Fig. 3a illustrates a force diagram of a prior art solution.

[0043] Fig. 3b illustrates a force diagram of the present solution.

[0044] Fig. 4 illustrates a top view of one embodiment of a vehicle seat arrangement comprising a deformation unit.

[0045] Fig. 5 illustrates an embodiment of a deformation unit.

[0046] Fig. 6a illustrates an embodiment of a deformation unit.

[0047] Fig. 6b illustrates part of an embodiment of the deformation unit.

[0048] Fig. 7a illustrates an embodiment of a deformation unit.

[0049] Fig. 7b illustrates a cross section of an embodiment of the deformation unit.

[0050] Fig. 8 illustrates another embodiment of a deformation unit.

[0051] Fig. 9 for reference purposes illustrates a vehicle in a coordinate system.

Description of embodiments

[0052] In the following, a detailed description of different embodiments of the vehicle seat arrangement is disclosed under reference to the accompanying drawings. All examples herein should be seen as part of the general description and are therefore possible to combine in any way of general terms. Individual features of the various embodiments and aspects may be combined or exchanged unless such combination or exchange is clearly contradictory to the overall function of the disclosed arrangement.

[0053] Briefly, the invention relates to a method and vehicle seat arrangement for decreasing the force exerted on a vehicle user during a collision, crash, or accident. The terms collision, crash, and accident are herein used as interchangeable terms for a situation different from a normal driving state of the vehicle and wherein there is a risk for injury of the users. The solution comprises a deformation unit with a deformation portion that is adapted to deform evenly with a linear force absorption in order to decrease the G-force that the user is subjected to.

[0054] Figure 1 illustrates one embodiment of a vehicle seat 10 in a vehicle seat arrangement 1 which is adapted to be arranged in a vehicle. The vehicle can be any form of vehicle, such as a motor vehicle, car, truck, or any other form of

vehicle. The vehicle seat 10 comprises a back portion 11 and a seat portion 12, the seat portion comprises a front section 12a and a rear section 12b. Within the vehicle seat is a support carpet arranged to support the weight of the person sitting in the vehicle seat. The support carpet can be made from different materials but is in one embodiment, as used herein as an example, constituted of at least one spring 13. The support carpet has a constant length but can be adapted to spring / absorb movements to provide a comfortable ride. The support carpet has a deformation unit 20 arranged that allows the support carpet to become longer and thereby absorb forces during an accident, crash, or collision. This will be further described below.

[0055] Figure 2a and 2b illustrates solutions of the prior art wherein uneven deformation is utilized to absorb forces during an accident. The attachment portion 21 is attached to the support carpet and during an accident a first force f1 tries to push the attachment portion 21 and deforming the deformation portion 22. At the same time the deformation portion 22 is providing resistance, the force f2 as illustrated in figure 2a. When the first force f1 exceeds a threshold it is larger than the second force f2 and the deformation portion 22 is deformed to the form of a sinus wave as illustrated in figure 2b.

[0056] Figure 3a illustrates a force diagram for the deformation as illustrated between figure 2a and 2b. The force during normal usage is below the force threshold 50 and do not cause any plastic deformation to the deformation unit 20. The diagram in figure 3a and 3b only illustrates the situation wherein an accident has occurred and the threshold 50 is exceeded initiating the plastic deformation 51, 52. The plastic deformation 51 as illustrated in figure 3a illustrates the force Δf that is absorbed through the deformation of the deformation portion 22. As illustrated in figure 3a the wrinkling of the sheet metal as the prior art proclaims causes the force to be absorbed uneven. This creates spikes of G-forces from the high values and losses of absorption capacity during the low parts of the cycle.

[0057] Figure 3b illustrates a force diagram of the deformation as performed by the present solution. When the force exceeds the force threshold 50 the

absorption of force 52 is constant creating a system which is more effective than the prior art solutions. Furthermore, the solution is gentler towards the passengers of the vehicle.

[0058] Figure 4 illustrates a top view of a vehicle seat arrangement 1 wherein the vehicle seat 10 is open in a way that the interior is visible. The interior comprises a support carpet 13 and a deformation unit 20. The support carpet has a length L1 which when the deformation portion 22 of the deformation unit 20 is deformed becomes longer and thereby absorbs the force.

[0059] Many prior art solutions arrange the deformation unit 20 at the chassis of the vehicle seat utilizing that the seat can be arranged in different positions. The problem with this is that if the vehicle seat is located in a location wherein the user has entered the setting closest to the floor the deformation portion 22 becomes very short. This has the effect that for large users some of the prior art solutions do not work. As illustrated in figure 4 this is addressed through in one embodiment arranging the deformation unit 20 in relation to the support carpet 13 of the vehicle seat 10. This solution instead utilizes the flex in the soft materials of the vehicle seat 10 as well as the space within the vehicle seat 10 to allow for force absorption.

[0060] Figure 5 illustrates an embodiment of the deformation unit 20 comprising dual deformation portions 22 and dual attachment portions 21. The attachment portions 21 are attached to the support carpet 13 either between the support carpet 13 and an attachment means thereof or somewhere along the extension direction of the support carpet 13. The embodiment as illustrated in figure 5 utilizes a solution wherein deformation occurs through movement of the attachment points 21 in such a way that the deformation portions 22 are teared partly from its attachment to the deformation unit. The deformation unit 21 is in one embodiment manufactured in one piece and adapted to allow for the deformation portion 22 to be teared away from the main body of the deformation unit 21 when the predetermined threshold 50 is exceeded. Through tearing the material by creating a movement similar to the one occurring when a tin can is opened an even

absorption of force is created while the length L1 of the support carpet 13 is increased. The length is increased through increasing the length of the deformation unit 20 which is attached to the support carpet 13 extending the overall distance the support carpet 13 extends.

[0061] Figure 6a illustrates an embodiment of the deformation unit 20 wherein the support carpet 13 consist of a thread structure or a spring structure. The spring or thread 21 is arranged in a loop and kept in place by a bracket 61 securing the spring or thread 21 in a way that the overall length of the support carpet 13 is decreased to the length suitable for normal operation of the vehicle. The solution utilizes that the bracket 61 is adapted to give way gradually in a linear deformation pattern if forces exceeds a predetermined threshold 50. When the bracket 61 gives way the length of the support carpet 13 is increased and force is absorbed by the bracket 61. The bracket 61 is, as illustrated in figure 6b, adapted to give way through the attachment portion 21 deforming the deformation portion 22. The deformation portion 22 is in one embodiment made from a polymer material and adapted to be teared creating a constant force absorption.

[0062] In one embodiment are a bracket 61 arranged on each thread / spring of the support carpet 13. In another are only some of the threads comprising a bracket 61. In yet another embodiment is each bracket adapted to host multiple threads / springs.

[0063] Figure 7a illustrates an embodiment of the deformation unit 20 that comprises attachment points 21 adapted to be dragged through the deformation portion 22 which in this embodiment is a pipe structure 22. The illustration in figure 7 illustrates merely an example of one solution wherein the attachment points 21 are dragged through the deformation portions 22. The person skilled in the art understands that any number of pipe structures 22 can be used and that the example comprising two pipe structures only is for illustrative purposes.

[0064] In one embodiment is the deformation portion 22 weakened by a longitudinal weakening 23, the weakening 23 being adapted to ensure that the absorption of force is at the right level for the application area. The weakening 23

can be any form of weakening such as a slit, aperture, any number of holes, recess, or any other form of structural weakening. In one embodiment is the socket / pipe structure 22 adapted to open up at the weakening 23 during deformation.

[0065] Figure 7b illustrates a cross section of the deformation unit 20 as described in figure 7a.

[0066] Figure 8 illustrates an embodiment of the deformation unit 20 wherein an aperture 25 is arranged extending part of the length of the deformation unit 20. The attachment portion 21 is arranged within the aperture 25 and is at least partly larger than the main portion of the aperture. In a normal driving state wherein the vehicle is not subjected to forces beyond a predetermined threshold 50 is the attachment portion 21 fixed in engagement at its standard position, as shown in figure 8. If a force exceeding the predetermined threshold 50 occurs, the attachment portion 21 is adapted to move along the recess and bend the edges 27 in order to make the aperture equally wide along its extension direction. The bending of the edges 27 provides a constant resistant that is utilized for absorbing the force.

[0067] Figure 9 illustrates a vehicle 99 in a coordinate system for reference purposes. The directions x, y, z is above used for describing the direction of forces and absorption thereof.

CLAIMS

1. A vehicle seat arrangement (1) in a vehicle, wherein said vehicle seat arrangement (1) comprises a vehicle seat (10) with a back portion (11) and a seat portion (12), said seat portion (12) comprises a front section (12a), adapted to support legs and knees of a user, and a rear section (12b) adapted to support the user's weight, said rear section (12b) of the vehicle seat (10) comprises a deformation unit (20) adapted to reduce the force exerted on the user during a crash, the force being absorbed through plastic deformation of a deformation portion (22), **characterized in that** the deformation portion (22) is adapted to deform with a linear deformation property (52) of the energy absorption, after a force threshold (50) is exceeded.

2. The vehicle seat arrangement (1) according to claim 1, wherein the deformation unit (20) further comprises an attachment portion (21) that during deformation moves in a direction that deforms the deformation portion (22).

3. The vehicle seat arrangement (1) according to claim 2, wherein said vehicle seat further comprises a support carpet (13).

4. The vehicle seat arrangement (1) according to any one of claims 1-3, wherein the deformation unit (20) and deformation portion (22) thereof is rigid during normal driving conditions and only deforms in the event of a crash.

5. The vehicle seat arrangement (1) according to claim 2, wherein the attachment portion (21) is adapted to progressively tear the deformation portion (22) after the force threshold (50) has been exceeded.

6. The vehicle seat arrangement (1) according to claim 3, wherein the attachment portion (21) is arranged as a part of the support carpet (13).

7. The vehicle seat arrangement (1) according to any one of claims 3 or 6, wherein the support carpet (13) is a support carpet (13) with a thread structure.

8. The vehicle seat arrangement (1) according to claim 2, wherein the attachment portion (21) is a socket (21) adapted to be dragged through a pipe structure (22) with resistance when the force threshold (50) is exceeded.

9. The vehicle seat arrangement (1) according to claim 8, wherein the pipe structure (22) has an elongated weakening (23) allowing the pipe structure (22) to deform when the socket (21) is dragged through the pipe structure (22).

10. The vehicle seat arrangement (1) according to claim 2, wherein the attachment portion (21) is arranged in an aperture (25) in the deformation portion (22) and is at least partly larger than the main portion of the aperture, the aperture (25) comprises edges (27) bent in a specific direction, and the attachment portion (21) is adapted to deform the deformation portion (22) by folding the edges (27) making the aperture (25) an elongated aperture (25) of a substantially equal width, the width being substantially the same as the width of the attachment portion (21) after deformation.

11. The vehicle seat arrangement (1) according to any one of claims 3, 6, or 7, wherein the deformation unit (20) is a bracket comprising a deformation portion (22) arranged to limit the length of the support carpet (13).

12. A method for a vehicle seat arrangement (1) in a vehicle, wherein said vehicle seat arrangement (1) comprises a vehicle seat (10) with a back portion (11) and a seat portion (12), said seat portion (12) comprises a front section (12a), adapted to support legs and knees of a user, and a rear section (12b) adapted to support the user's weight, said rear section (12b) of the vehicle seat (10) comprises a deformation unit (20) adapted to reduce the force exerted on the user during a crash, the force being absorbed through plastic deformation of a deformation portion (22), wherein the method is **characterized in that**
- when a certain force threshold (50) is exceeded,
- deforming the deformation portion (22) with a linear deformation property (52) of the energy absorption.

13. The method according to claim 12, wherein the deformation unit (20) further comprises an attachment portion (21) that during deformation is moving in a direction that deforms the deformation portion (22).

14. The method according to any one of claims 12 or 13, wherein the vehicle seat arrangement (1) is a vehicle seat arrangement (1) according to any one of claims 2-11.

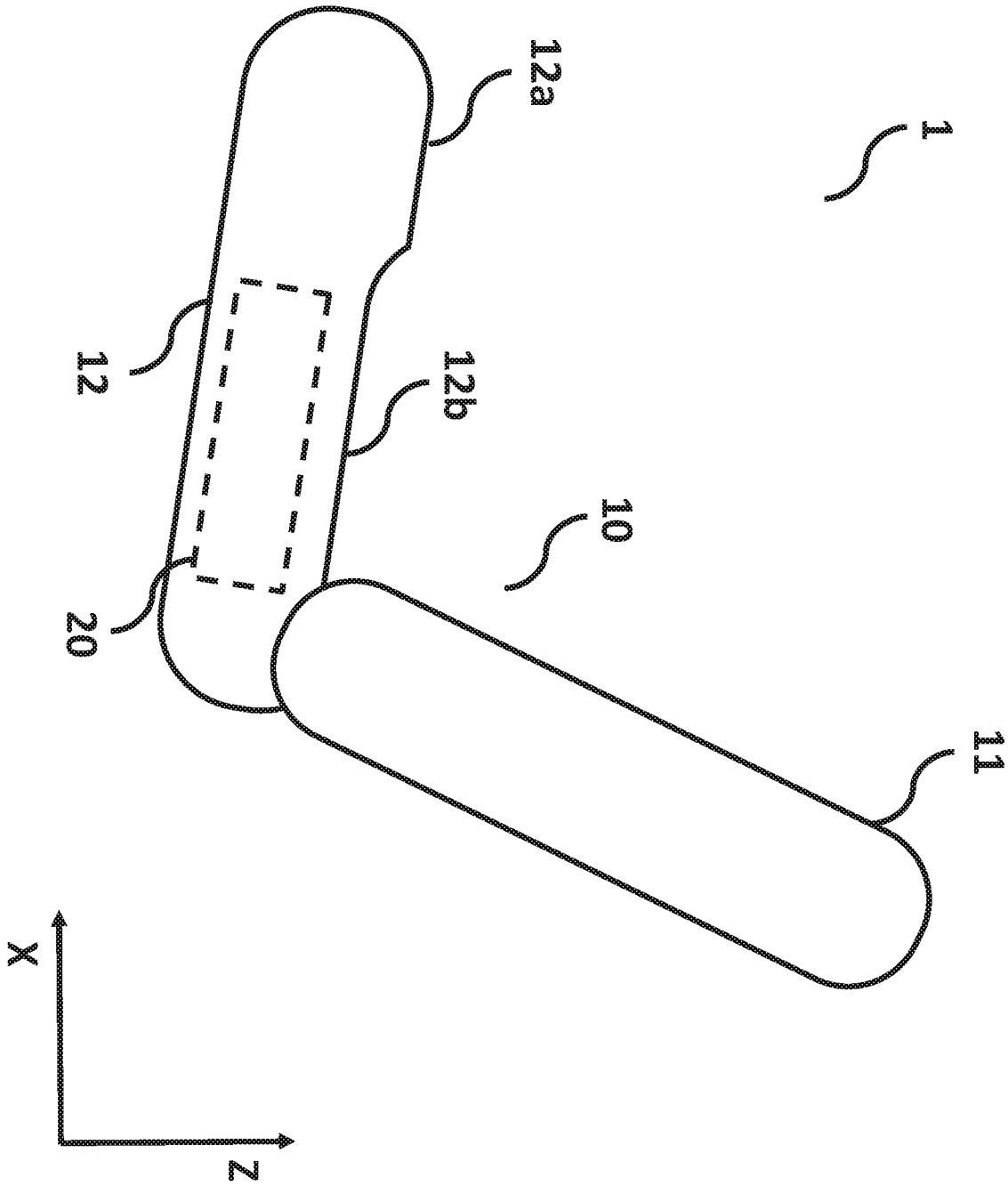


Fig. 1

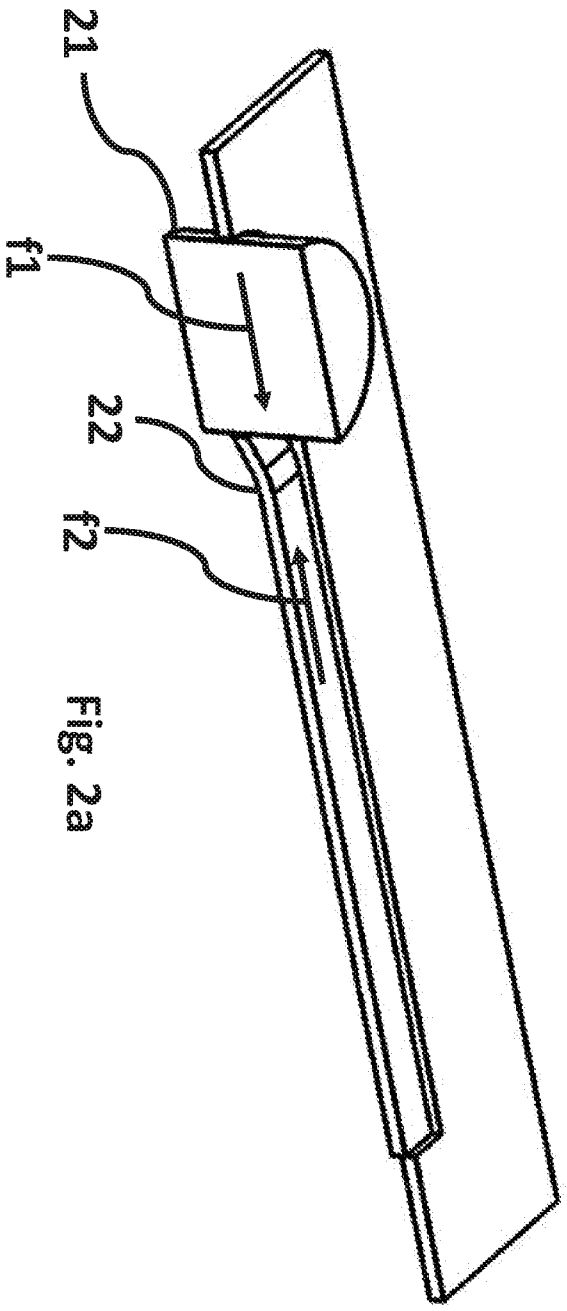


Fig. 2a

Prior art

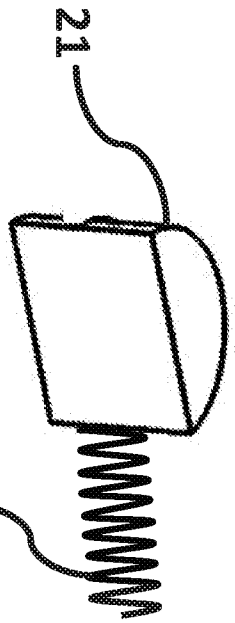
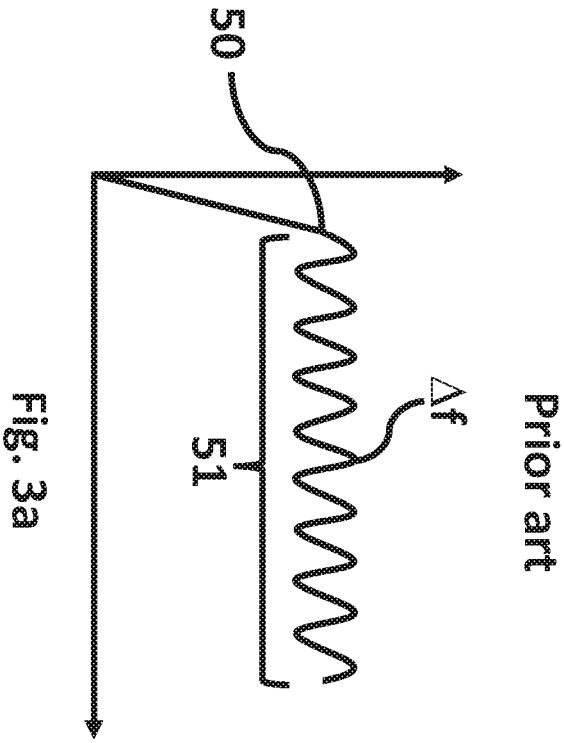


Fig. 2b



Prior art

Fig. 3a

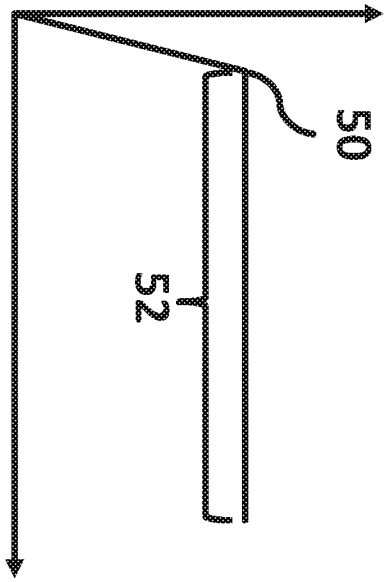


Fig. 3b

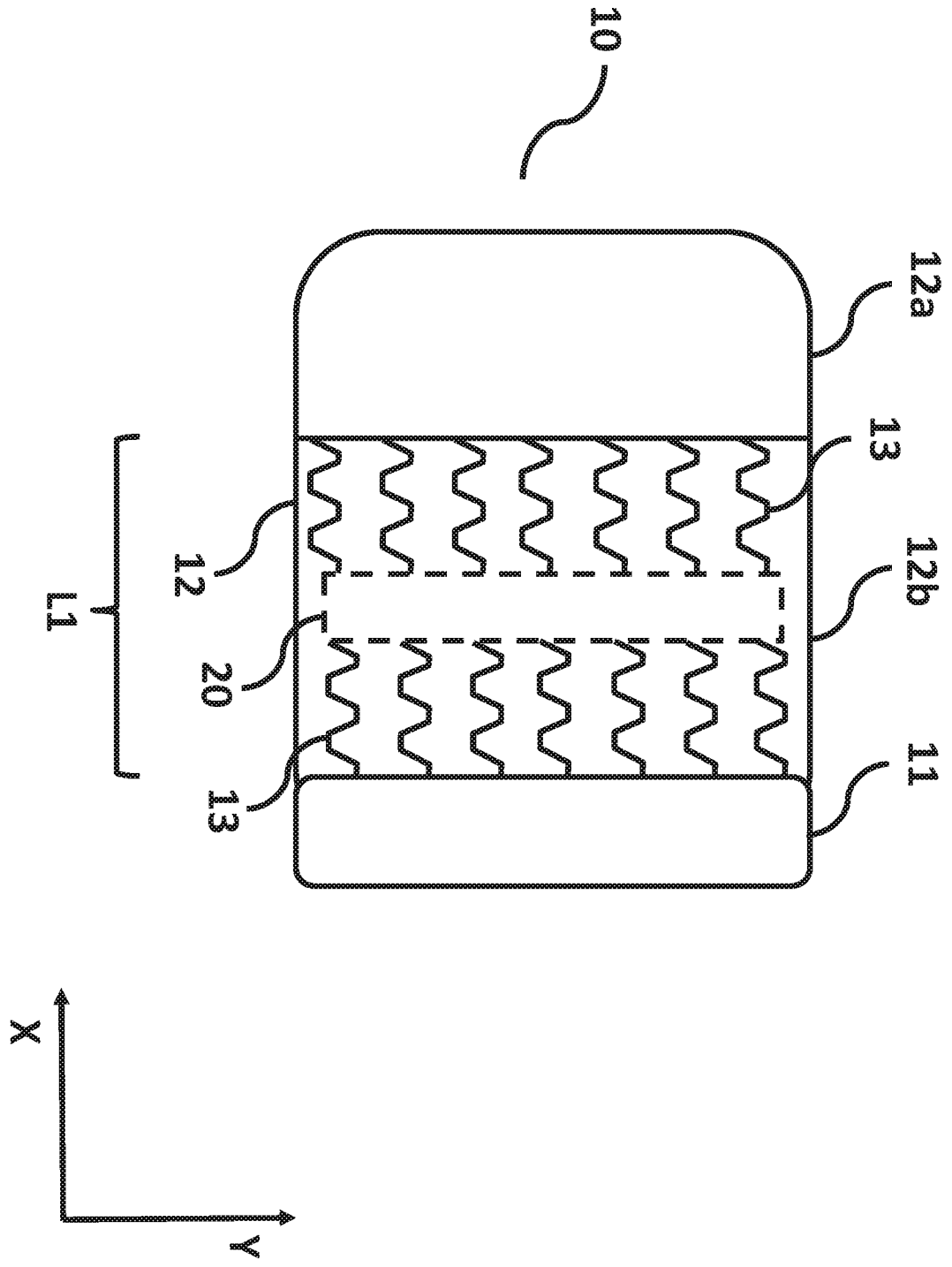


Fig. 4

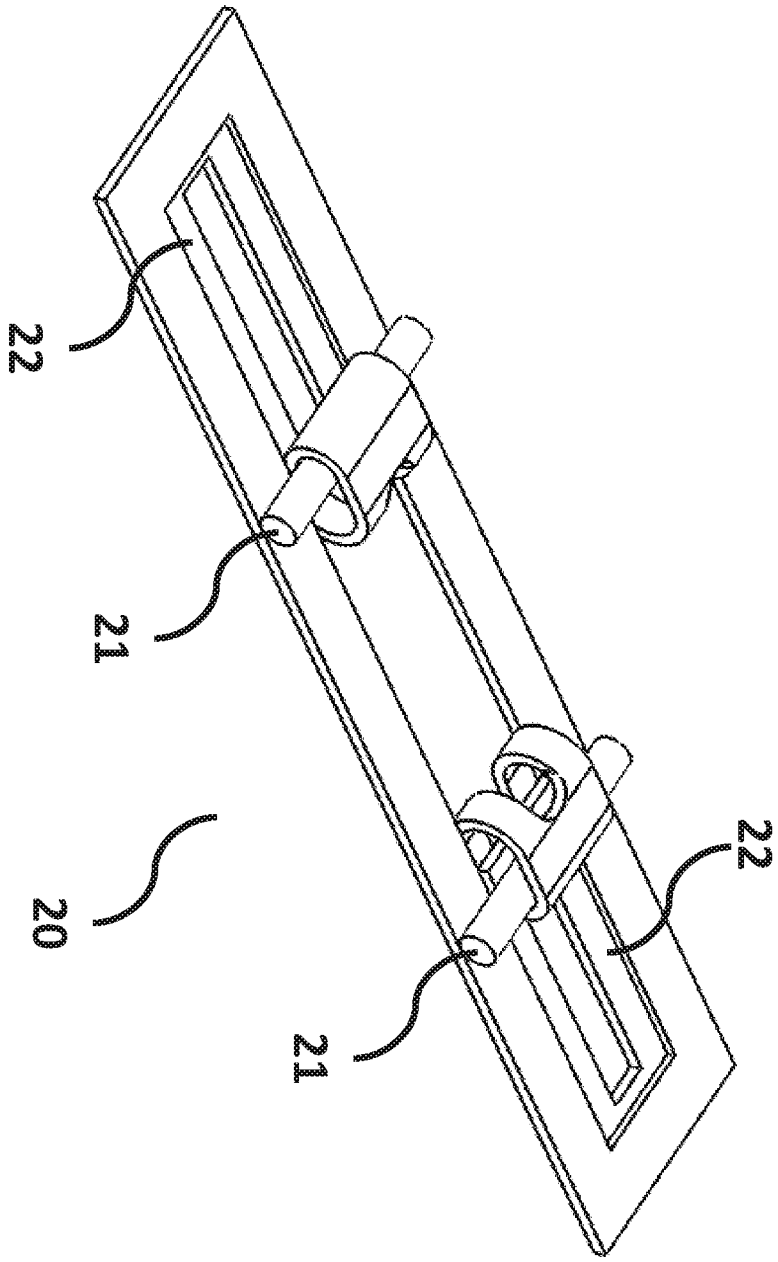


Fig. 5

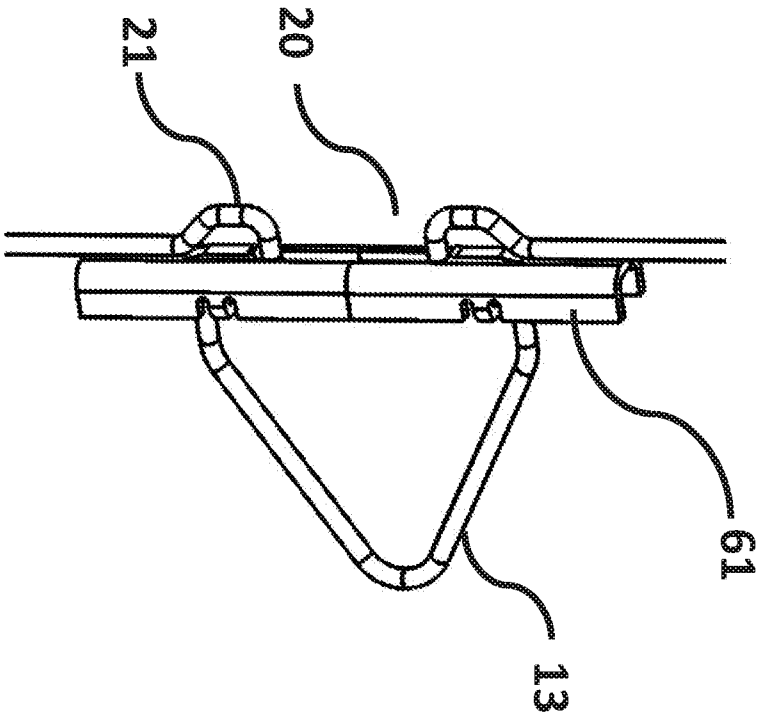


Fig. 6a

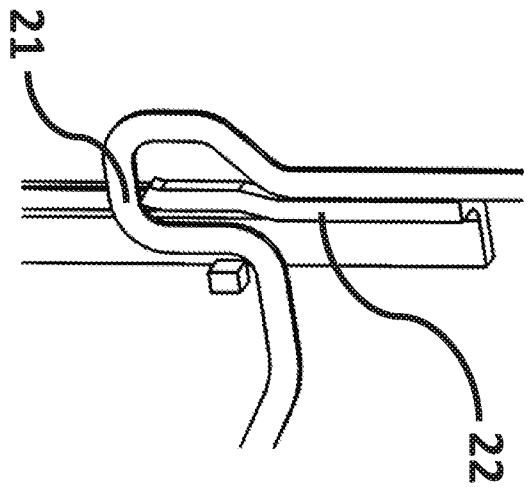


Fig. 6b

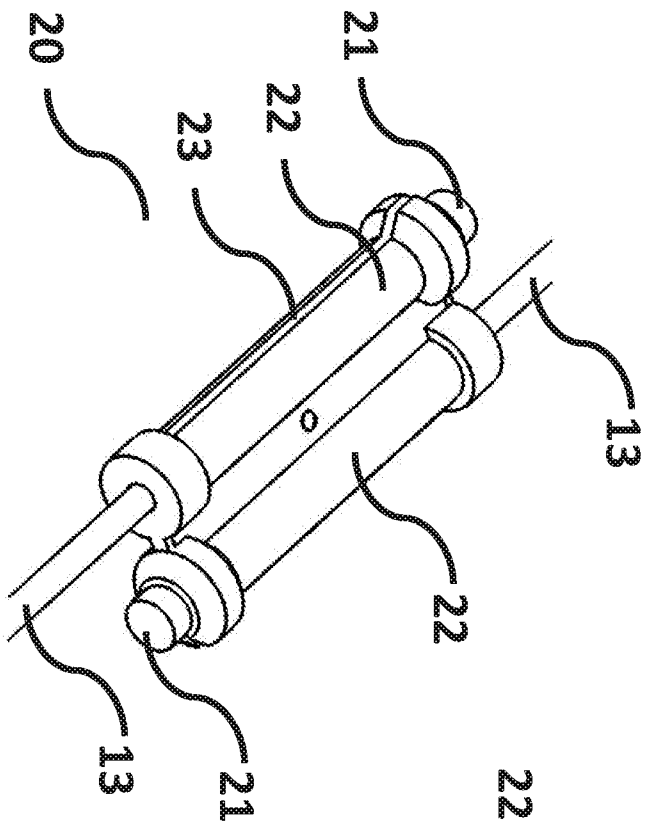


Fig. 7a

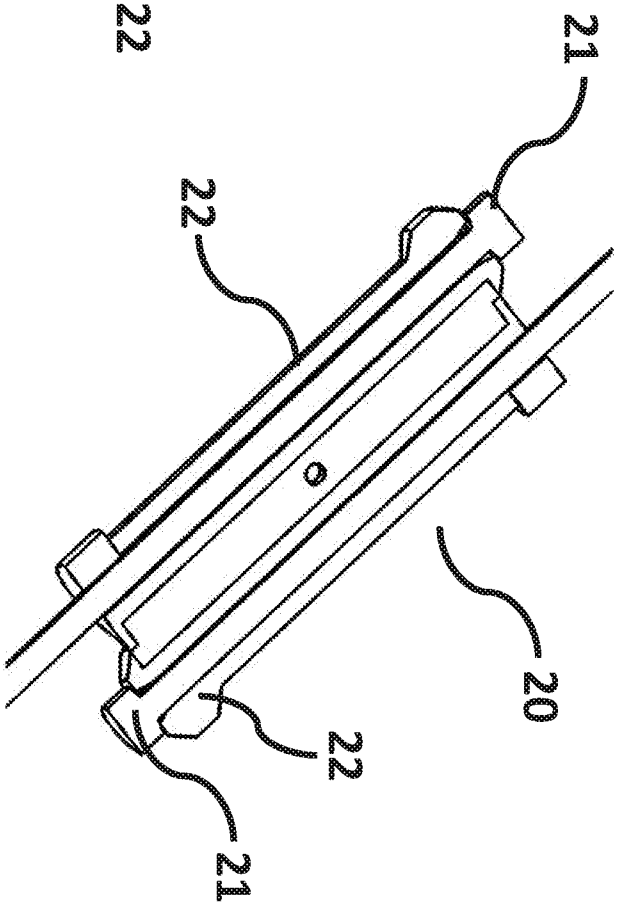


Fig. 7b

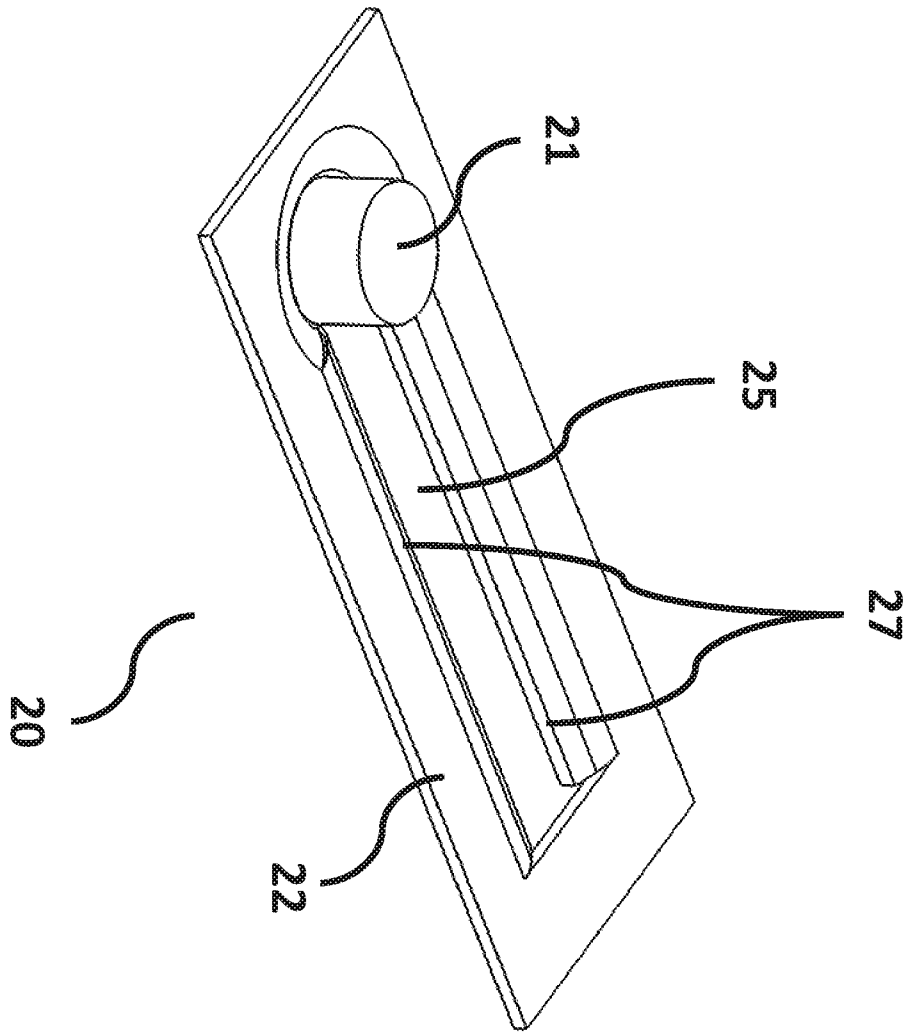


Fig. 8

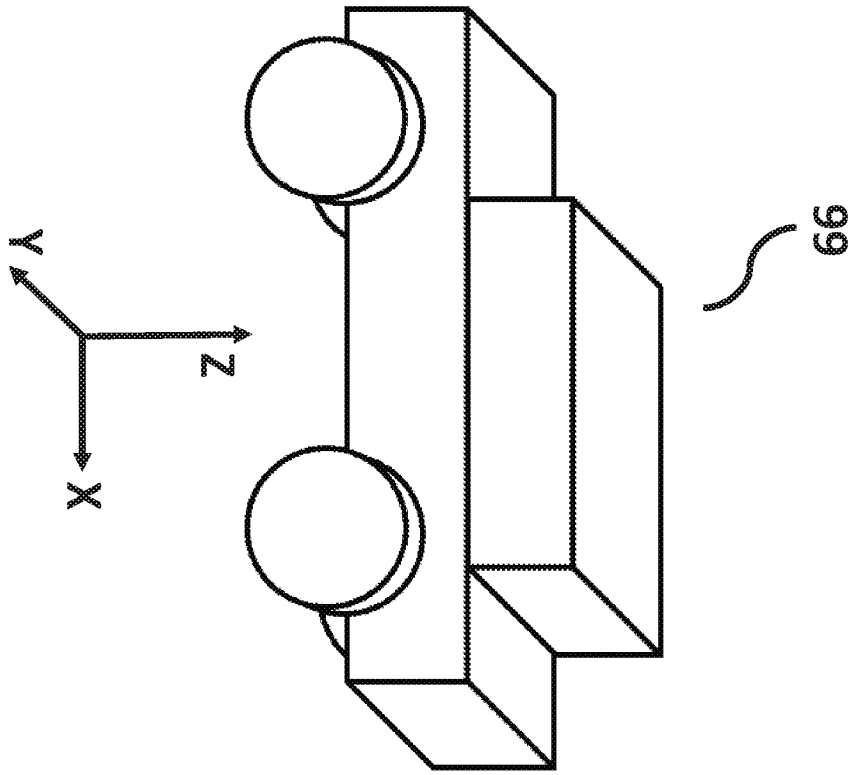


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2016/055323

A. CLASSIFICATION OF SUBJECT MATTER

B60N 2/42(2006.01)i

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)

B60N 2

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)

CPRSABS;VEN:B60N2, deform+, spring, elastic+, flexib+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 1668489 A (DELTA TOOLING CO LTD) 14 September 2005 (2005-09-14) paragraph 2 page 7 of the specification figures 1-6	1、12
Y	CN 1668489 A (DELTA TOOLING CO LTD) 14 September 2005 (2005-09-14) paragraph 2 page 7 of the specification figures 1-6	2-11、13-14
Y	DE 102007003160 A1 (FAURECIA AUTOSITZE GMBH) 24 July 2008 (2008-07-24) figures 2 and 3	2-11、13-14
A	CN 2568466 Y (ZHANG HAIPING) 27 August 2003 (2003-08-27) the whole document	1-14
A	CN 103974851 A (BROSE FAHRZEUGTEILE GMBH AND CO. KG) 06 August 2014 (2014-08-06) the whole document	1-14

☐ Further documents are listed in the continuation of Box C.

☑ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 November 2016	**15 December 2016**

Name and mailing address of the ISA/CN	Authorized officer
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2016/055323

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	1668489	A	14 September 2005	EP	1552981	A1	13 July 2005
				US	2005231011	A1	20 October 2005
				WO	2004007238	A1	22 January 2004
				JP	4554362	B2	29 September 2010
				TW	200402277	A	16 February 2004
				KR	20050013178	A	02 February 2005
DE	102007003160	A1	24 July 2008		None		
CN	2568466	Y	27 August 2003		None		
CN	103974851	A	06 August 2014	WO	2013079185	A1	06 June 2013
				DE	102011055860	A1	06 June 2013
				US	2014339865	A1	20 November 2014
				DE	112012004974	A5	14 August 2014