

## TECHNICAL FIELD

The present invention relates to a seat belt restraint.

## BACKGROUND ART

5 The three-point seat belt retains the wearer in their seat while spreading the energy of a collision over some of the body's hard points, such as the chest, pelvis, and shoulders.

It has been found however that it is possible for a person wearing a three-point seat belt to 'submarine' out of the belt in the event of a collision.

10 Submarining is the term used to describe the action when a vehicle occupant slides out from under their seat belt during a collision. Submarining can cause serious, even life threatening injuries to the legs, spine and internal organs. Children and small adults are particularly prone to submarining out of their seat belts in a collision.

15 Five and six point harness systems prevent submarining by using one and two crotch straps respectively, but this is neither comfortable nor convenient for everyday use.

It is an object of the present invention therefore to provide a seat belt restraint that substantially prevents this submarining, or at the least, provides a useful alternative to the seat belts of the prior art.

20 Other objects and advantages of the present invention will become apparent from the following description, taken in connection with the accompanying

drawings, wherein, by way of illustration and example, an embodiment of the present invention is disclosed.

### DISCLOSURE OF THE INVENTION

5 In one form of this invention there is proposed a seat belt restraint including a single, continuous length of belt supporting at least two releasably engageable portions of a seat belt buckle.

In a further form the invention may be said to reside in a seat assembly including a seat belt restraint that further includes a single, continuous length of belt supporting at least two releasably engageable portions of a seat belt buckle.

10 Preferably, the seat belt restraint including a belt having a first end fixed to an anchor point, a second end retaining a first portion of a seat belt buckle, and a second portion of a seat belt buckle that is adapted to releasably engage the first portion of the seat belt buckle, said second portion being retained by the belt so that it is free to slide along the belt.

15 Preferably, a portion of the belt passes beneath a portion of the wearers seat, so that the anchor point and the first portion of the buckle are on opposite sides of the seat when not in use.

Preferably, the first portion of the seat belt buckle is adapted to receive part of the second portion in a releasable engagement.

20 Preferably, the wearer's seat includes a base portion and a back portion.

Preferably, a portion of the seat belt passes beneath the base of the wearers seat.

Preferably, the base of the wearers seat is adapted to be curled up around their legs when a belt pretensioner deploys.

5 Preferably, the first portion of the seat belt buckle is a receiving portion, and the second portion is an insertion portion that is adapted to releasably engaged by the receiving portion.

Preferably, the anchor point comprises an inertia reel mechanism.

Preferably, the inertia reel mechanism includes a belt pretensioner.

Preferably there is an anchored belt guide positioned at or toward each side of the base of the wearers seat.

10 Preferably, the anchored belt guides are mounted to a base portion of the seat frame.

Preferably, in use the lower part of the lap belt sits anterior to the "sit" or ischial bones, while the upper lap sits anterior to the "pelvic" or iliac bones.

15 Preferably, the seat belt restraint includes a belt guide, over which the belt passes, the guide being support by biasing means.

Preferably, when the belt pretensioner activates, the belt guide is pulled downward against the biasing means so as to increase the extent to which the belt wraps over the shoulder of the wearer.

20 Preferably, the inertia reel mechanism and belt guide are mounted to the seat frame. This creates what we call a seat module.

In a further form, the invention may be said to reside in a method of wearing the seat belt described above, wherein a portion of the belt passes beneath the

wearers seat so that the receiving portion of the buckle is accessible to a first side of the wearer, and the insertion portion of the buckle is drawn from the other side of the wearer and releasably engaged by the receiving portion, thereby looping the belt around the legs of the wearer and the seat portion  
5 beneath their legs.

In a further form, the belt is wrapped around a leg of the wearer, and the two portions of the seat belt buckle are engaged.

Preferably, the belt is worn in conjunction with a standard three-point belt.

Preferably, the belt passes beneath the lap portion of the standard three-point  
10 belt.

Preferably, the belt is adapted to be retrofitted to a vehicle.

Preferably, the anchor point for the belt is a mount point for a baby capsule.

In a further form, the invention may be said to reside in a method of wearing the seat belt described above, wherein the belt is wrapped around a leg of the  
15 wearer, and the two portions of the seat belt buckle are releasably engaged.

In a further form, the invention may be said to reside in a kit of parts for the seat belt restraint described above.

In a further form, the invention may be said to lie in a seat belt including a portion adapted to loop around a leg of a wearer.

**BRIEF DESCRIPTION OF THE DRAWINGS**

For a better understanding of this invention it will now be described with respect to the preferred embodiment which shall be described herein with the assistance of drawings wherein;

5 Figure 1 is a perspective view of a vehicle seat incorporating a seat belt;

Figures 2 and 5 are perspective views of the vehicle seat in Figure 1, retaining a vehicle occupant in their seat;

Figures 3 and 4 are detailed perspective views of a seat belt guide for the seat belt shown in Figure 1;

10 Figure 6 is a perspective view of a seat belt according to a further form of the invention;

Figure 7 is a perspective view of the seat belt in Figure 6 retaining a vehicle occupant in their seat; and

15 Figure 8 is a perspective view of a frame for a seat belt restraint according to a further embodiment of the invention;

Figure 9 is a perspective view of a vehicle seat incorporating the seat belt frame and restraint in Figure 8;

Figure 10 is a perspective view of the vehicle seat and seat belt restraint in Figure 9 restraining an occupant; and

20 Figures 11 and 12 are perspective views of a frame for a seat belt restraint according to a further embodiment of the invention.

## DETAILED DESCRIPTION OF THE INVENTION

Referring now to Figure 1, where there is illustrated a vehicle seat 1 and a seat belt 2 for securing a wearer in the seat 1. The seat 1 includes a base portion 4 and a back portion 6.

- 5 The seat belt 2 has a first end that is anchored to the vehicle via an inertia-reel mechanism 8. A second end of the belt retains a receiving portion 10 of a seat belt buckle.

The inertia reel mechanism 8 is mounted to the seat frame (not shown). The belt is routed up from the reel 8 and passes over a belt guide 100 (see Figure 3).

- 10 The belt guide is a bar 102 with eyelets 104 formed into each of its ends, each of which runs on a rail 106 that is fixed to the seat frame. Each of the eyelets 104 rests atop a fully extended spring 108 that has been coiled around the rail 106.

- 15 A portion of the seat belt 2b then passes through a passageway beneath a base cushion 4 of the wearer's seat 1, so that the anchor point 8 and the receiving portion 10 of the buckle are on opposite sides of the seat base portion 4 when the belt is not in use. This base portion 4 is a cushion that is firmly secured to the vehicle.

- 20 There is an insertion portion 12 of the belt buckle, which is adapted to be received by and releasably engaged with the receiving portion 10. This insertion portion 12 has a slot through it, through which the seat belt 2 passes. The belt 2 retains the insertion portion 12 then so that it is free to slide along the belt 2.

The base cushion 4 of the wearers seat is adapted to be curled up around their legs if a belt tensioner deploys during an accident.

In use, a vehicle occupant sits 20 in the seat 1 and takes hold of the insertion 12 portion of the seat belt buckle. They then draw this across their body towards the receiving portion 10, and releasably engage the two portions of the belt buckle. In doing so, one portion of the seat belt 2a is drawn diagonally across their chest, and another portion 2c passes low across their thighs, while portion 2b passes beneath the seat.

In the event of a collision, the belt pretensioner will activate, pulling firmly on the belt 2. This will pull the bar 102 of the belt guide 104 down against the springs 108, increasing the extent to which the belt 2 wraps over and around the wearers shoulder (over their a-c joint). This limits the wearer's ability to slide sideways from beneath the belt (particularly in side impacts). The belt pretensioner also pulls the belt 2 firmly around the wearer's legs 22 and across their chest. This will also cause part of the seat base cushion 4 to be wrapped up and around the legs 22 of wearer 20 (see Figure 5).

The position of the belt 2 around the legs 22 of wearer and the distortion of the seat base cushion 4 then co-operates to prevent the wearer from submarining out of the belt. Similarly, the action of the belt guide 100 will prevent the wearer from being flung forwards from beneath the belt 2, a motion often referred to a 'jack-knifing'.

A significant advantage of mounting this seat belt restraint system to a seat frame is that this creates a seat module, to which the occupant is restrained. This is preferable to having a seat belt that is anchored to a portion of the vehicles roof structure (such as a roof pillar for instance), which may be significantly damaged in a collision, thereby reducing the degree of restraint provided to the wearer of the belt.

A seat module offers further advantages because it is better attached to its human cargo and can move with this cargo in a collision. It is by design more

akin to a baby capsule. A module can have passive and/or active attachment points to the vehicle. The advantages of this might be best described by way of example, using two commonly injurious scenarios:

1. Rear-end collision - The seat flexes with the tightly secured human eliminating head-headrest strike (so that whiplash injury is reduced); and
2. Rollover collision - The seats actively roll backwards in a knee-up, head down position (so that head/neck injury is reduced). This is achievable if a seat mount is deliberately released so that the seat action can mimic a "rocking chair".

Figures 1 through 5 illustrate a dedicated system, in which the seat base cushion 4 is adapted to allow the belt 2 to pass beneath it. Figures 6 and 7, illustrate a further form of the invention, this one being suited for retrofitment to vehicles, yet still preventing submarining.

As before, the seat belt 30 has a first end that is anchored to the baby capsule anchor point of the vehicle via an inertia-reel mechanism 32, and a second end that retains a receiving portion 34 of a seat belt buckle. Once again, the insertion portion 36 of the seat belt buckle has a slot through it, through which the seat belt 30 passes. The belt 30 retains the insertion portion 36 then so that it is free to slide along the belt 30.

In use, the belt 30 is wrapped around the leg 22 of the wearer 20 and the two portions of the buckle are engaged. When used in connection with a three-point seat belt 40, the belt 30 is passed beneath the lap portion of three-point belt 40, and prevents the wearer 20 from submarining out from beneath the three-point belt 40. In addition to this, when the pretensioner for this belt 30 activates, the fact that it has been routed beneath the lap portion of the three-point belt 40



reduces the extent to which this portion of the three point belt can impart abdominal injuries on the wearer in the event of a collision.

Referring now to Figure 8, where there is illustrated a seat frame 200 having a back portion 202 and a base portion 204. This frame 200 supports the vehicle seat cushions, as shown in Figure 9 and is adapted to be bolted to the vehicle.  
5 The first end of the belt 206 is mounted to the back portion 202 of the seat frame 200 via an inertial reel mechanism, in much the same fashion as was discussed above. The belt 208 then passes through a pair of belt guides 210 and 212 fixed to the base portion 204 of the frame 200, one mounted to each  
10 side of the base portion 204 of the seat frame.

Each of these belt guides has a slot in it, through which the seat belt 208 passes. Referring now to Figure 10, the purpose of these brackets 210 and 212 is to limit the extent to which the belt 208 can tighten around and thereby crush the legs 22 of the wearer in a severe impact.

15 Referring now to Figures 11 and 12, where the seat frame 300 incorporates a further pair of belt guides 302 and 304 connected to the base portion 306 of the seat frame 300 by brackets 308 and 310. These brackets 308 and 310 position these further belt guides 302 and 304 so that the lower part 312 of the lap belt sits anterior to the "sit" or ischial bones of the wearer, while the upper part 314 of  
20 the lap belt sits anterior to the "pelvic" or iliac bones. It has been found that these are the ideal positions for these further belt guides 302 and 304, in that these positions provide the best balance between secure retention of the wearer, without creating excessive crushing pressure on their legs.

Although the invention has been herein shown and described in what is  
25 conceived to be the most practical and preferred embodiment, it is recognised that departures can be made within the scope of the invention, which is not to be limited to the details described herein but is to be accorded the full scope of

the appended claims so as to embrace any and all equivalent devices and apparatus.

**CLAIMS**

1. A seat belt restraint including a single, continuous length of belt supporting at least two releasably engageable portions of a seat belt buckle.
2. A seat assembly including a seat belt restraint that further includes a  
5 single, continuous length of belt supporting at least two releasably engageable portions of a seat belt buckle.
3. The seat belt restraint as in either one of the preceding claims further characterised in that the belt has a first end fixed to an anchor point, a second end retaining a first portion of the seat belt buckle, and a second portion of the  
10 seat belt buckle that is adapted to releasably engage the first portion of the seat belt buckle, said second portion being retained by the belt so that it is free to slide along the belt.
4. The seat belt restraint as in any one of the preceding claims further characterised in that a portion of the belt passes beneath a portion of the  
15 wearers seat, so that the anchor point and the first portion of the buckle are on opposite sides of the seat when the belt is not in use.
5. The seat belt restraint as in any one of the preceding claims further characterised in that the first portion of the seat belt buckle is adapted to receive part of the second portion in a releasable engagement.
- 20 6. The seat belt restraint as in any one of the preceding claims further characterised in that the wearers seat includes a base portion and a back portion.

7. The seat belt restraint as in any one of the preceding claims further characterised in that a portion of the seat belt passes beneath the base of the wearers seat.

5 8. The seat belt restraint as in any one of the preceding claims further characterised in that the base of the wearers seat is adapted to be curled up around their legs at least to a limited extend when a belt pretensioner deploys.

9. The seat belt restraint as in any one of the preceding claims further characterised in that the first portion of the seat belt buckle is a receiving portion, and the second portion is an insertion portion that is adapted to be  
10 inserted into and releasably engaged by the receiving portion.

10. The seat belt restraint as in any one of the preceding claims further characterised in that there is an anchored belt guide positioned at or toward each side of the base of the wearers seat.

11. The seat belt restraint as in any one of the preceding claims further  
15 characterised in that the anchored belt guides are mounted to a base portion of a seat-supporting frame.

12. The seat belt restraint as in any one of the preceding claims further characterised in that the anchored belt guides retain the belt such that the lower part of the lap belt sits anterior to the "sit" or ischial bones, while the upper part of  
20 the lap belt sits anterior to the "pelvic" or iliac bones.

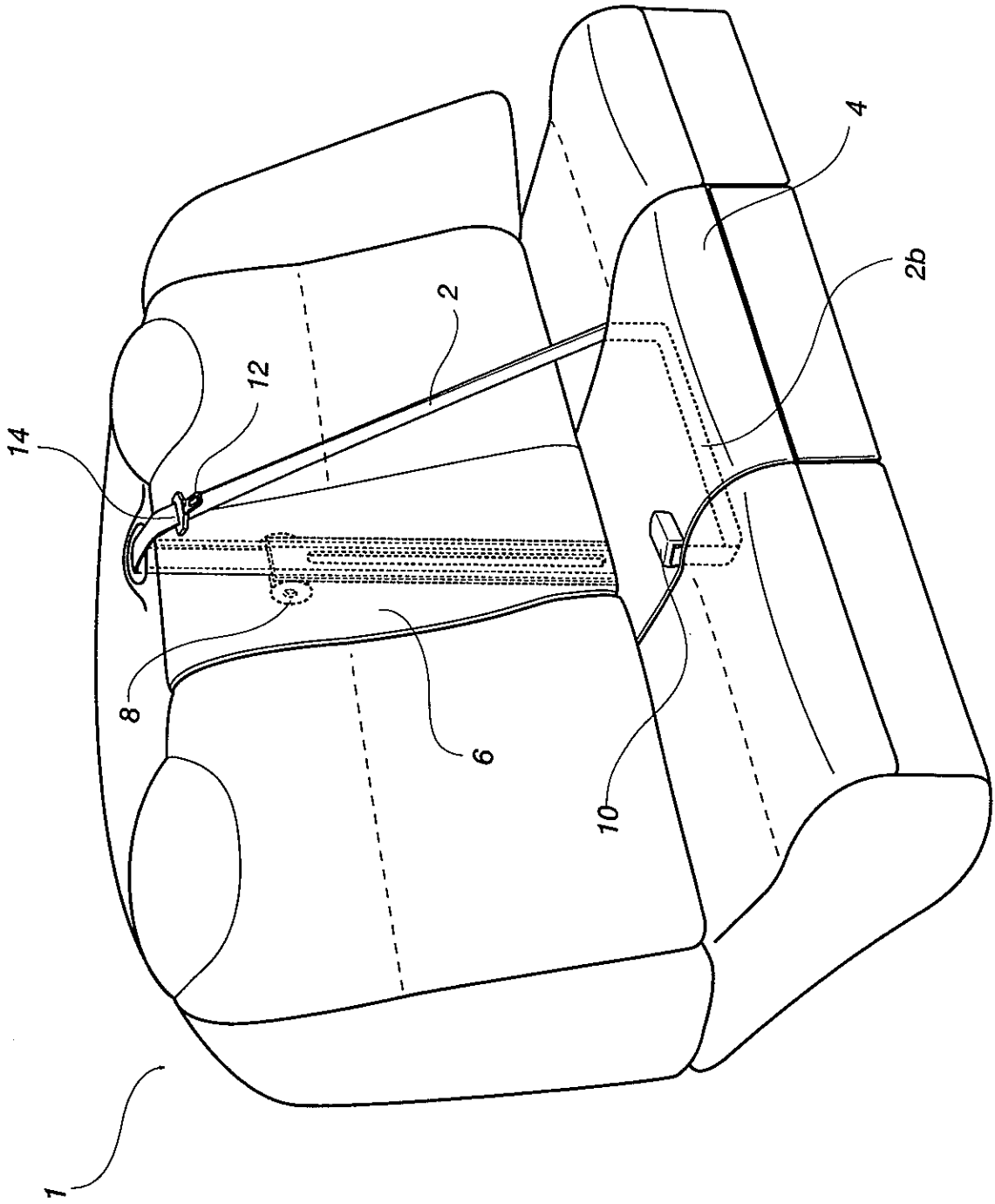
13. The seat belt restraint as in any one of the preceding claims further characterised in that the anchor point for the belt is a mount point for a baby capsule.

14. The seat belt restraint as in any one of claims 1 to 10 further characterised in that the anchor point to which the first end of the belt is fixed includes an inertia reel mechanism and a belt pretensioner.
15. The seat belt restraint as in any one of the preceding claims further  
5 characterised in that the seat belt restraint includes a belt guide, over which the belt passes, said guide being support by biasing means.
16. The seat belt restraint as in any one of the preceding claims further characterised in that when the belt pretensioner activates, the belt guide is pulled downward against the biasing means so as to increase the extent to  
10 which the belt wraps over the shoulder of the wearer.
17. The seat belt restraint as in any one of the preceding claims further characterised in that the inertia reel mechanism and belt guide are mounted to the seat frame.
18. A method of wearing the seat belt as disclosed in any one of the  
15 preceding claims, wherein a portion of the belt passes beneath the wearers seat so that the receiving portion of the buckle is accessible to a first side of the wearer, and the insertion portion of the buckle is drawn from the other side of the wearer and releasably engaged by the receiving portion, thereby looping the belt around both the legs of the wearer and the seat portion beneath their legs.
- 20 19. A method of wearing the seat belt described above, wherein the belt is wrapped around a leg of the wearer, and the two portions of the seat belt buckle are releasably engaged.
20. The seat assembly of claim 2, further characterised in that it includes a seat-supporting frame to which the belt assembly is attached.

21. A kit of parts for the seat belt restraint described in any one of the preceding claims.
22. A seat belt restraint as described in the specification with reference to and as illustrated in the accompanying representations.
- 5 23. A seat assembly as described in the specification with reference to and as illustrated in the accompanying representations.
24. A method of wearing a seat belt restraint as described in the specification with reference to and as illustrated in the accompanying representations.

**ABSTRACT**

The invention relates to a seat belt restraint that prevents submarining of a wearer. The belt has a first end fixed to an anchor point, a second end retaining a first portion of a seat belt buckle, and a second portion of a seat belt buckle  
5 that is adapted to releasably engage the first portion of the seat belt buckle, said second portion being retained by the belt so that it is free to slide along the belt.

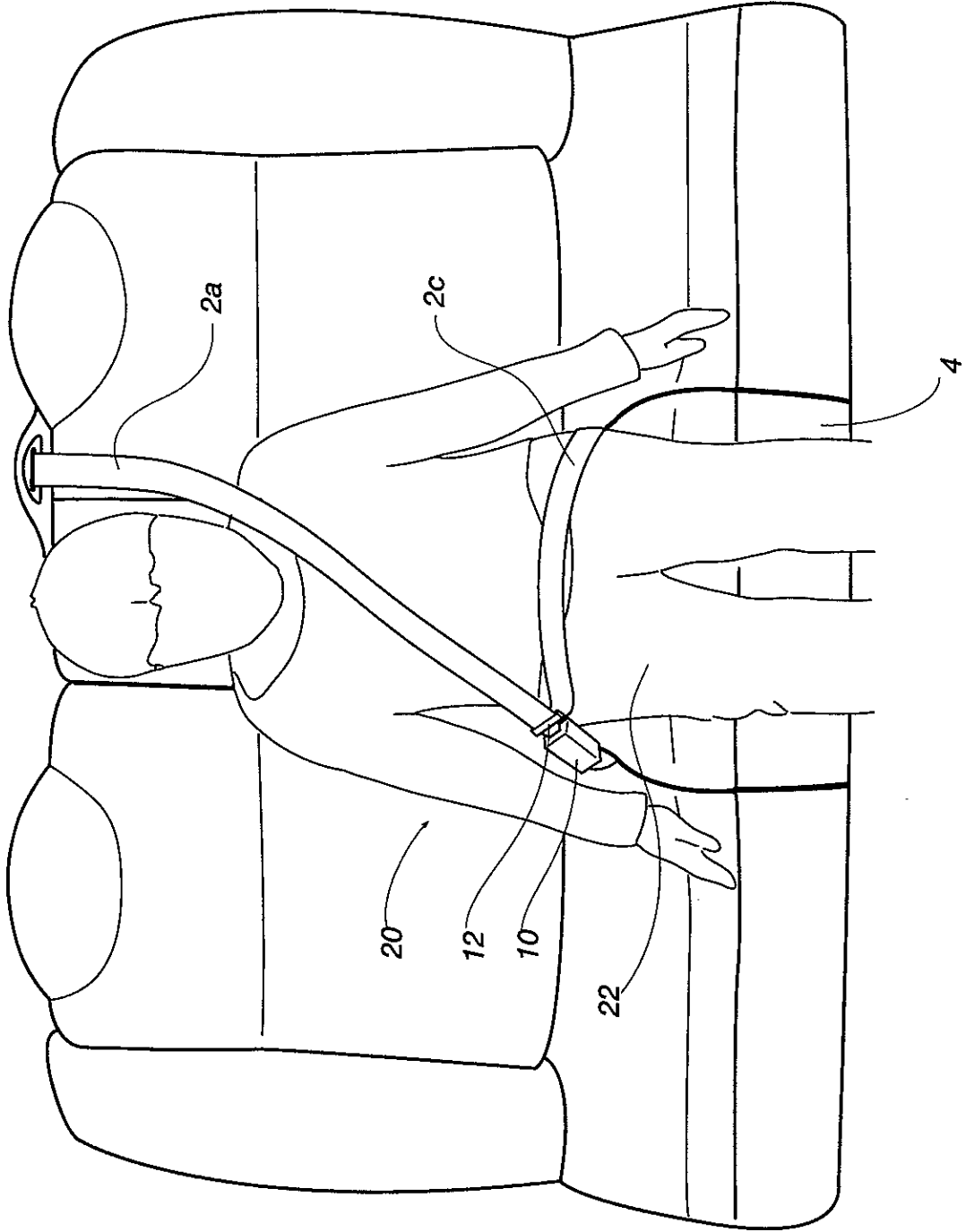


**Fig 1**

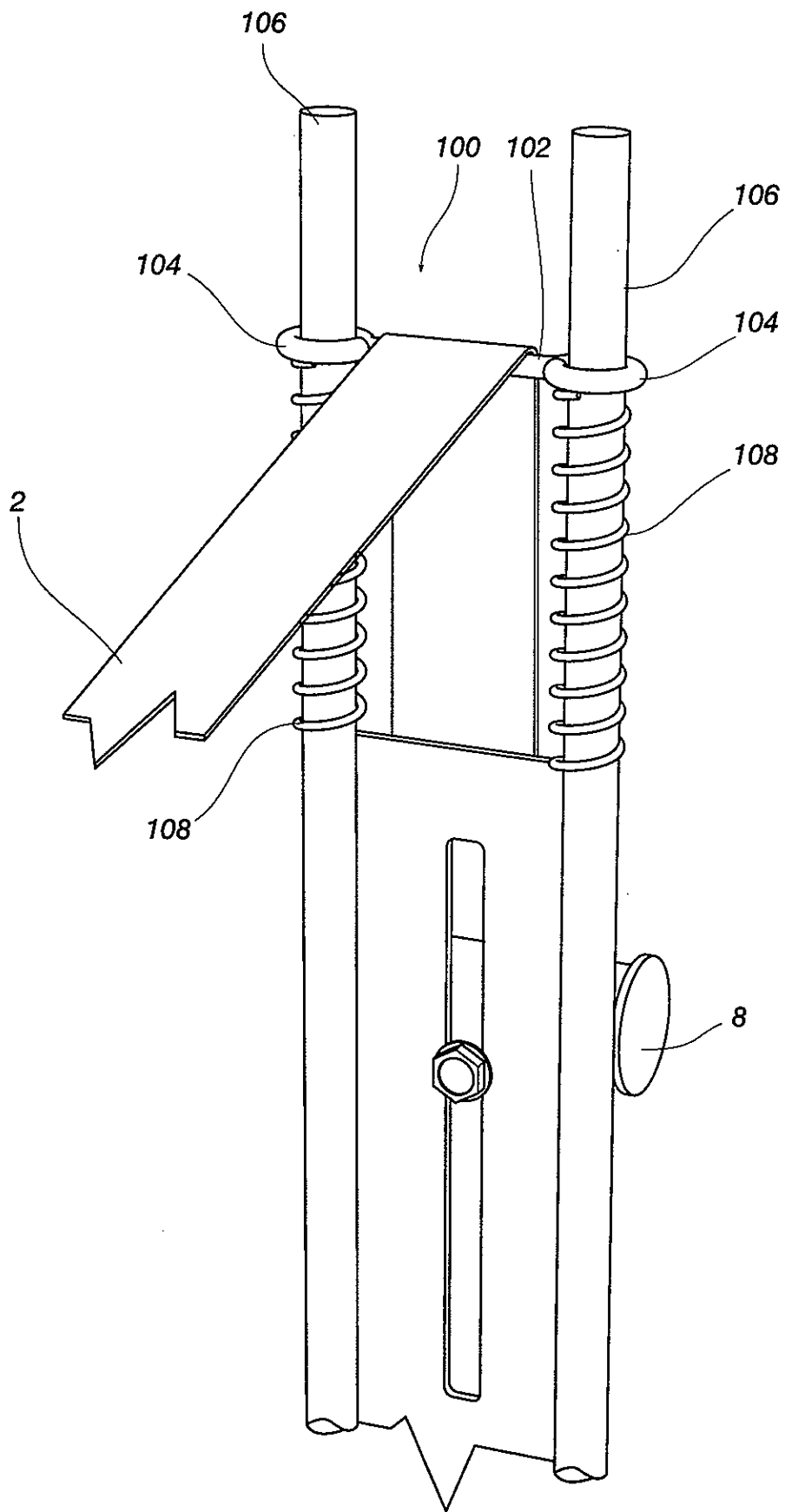


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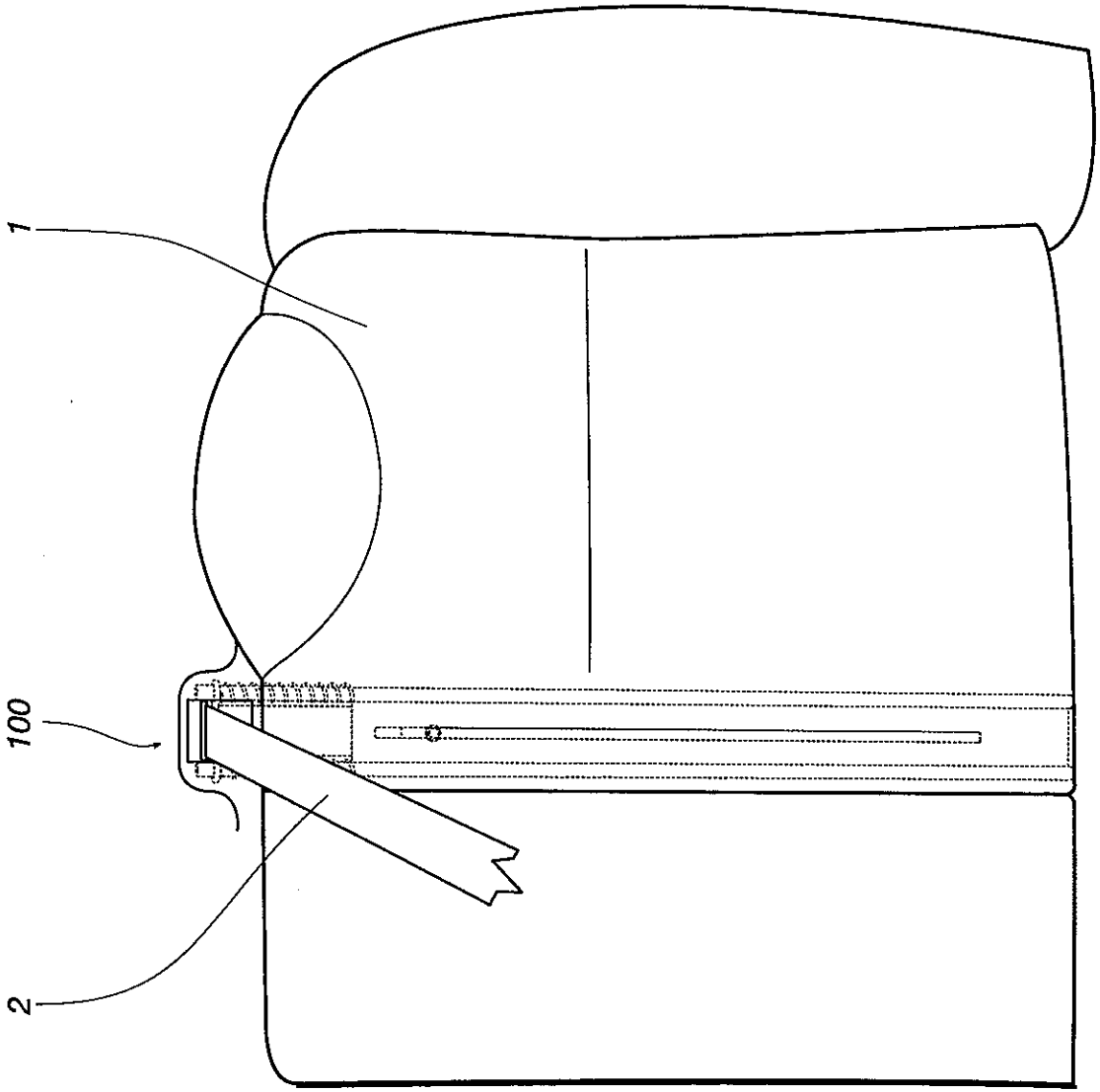
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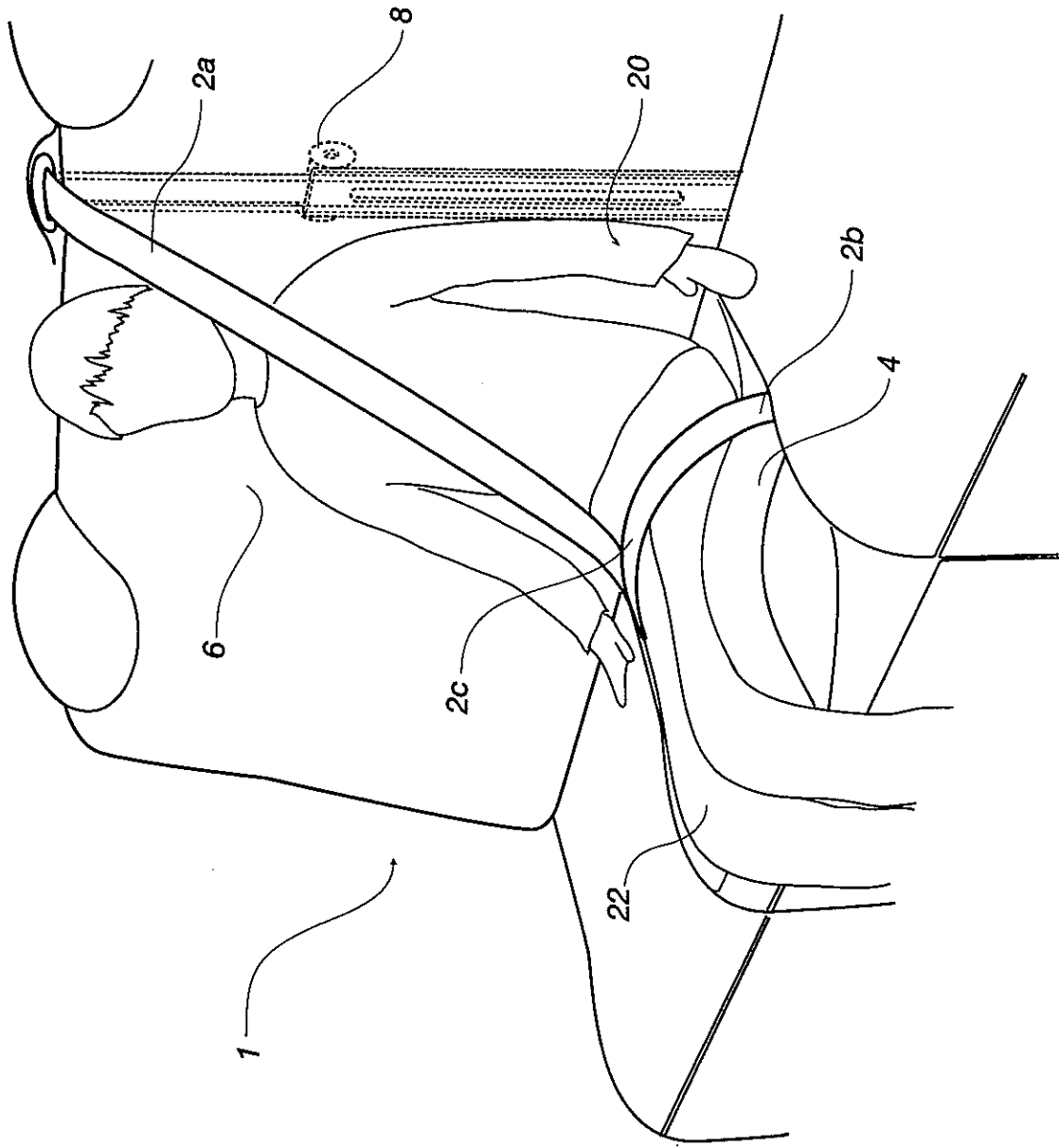
**Fig 2**



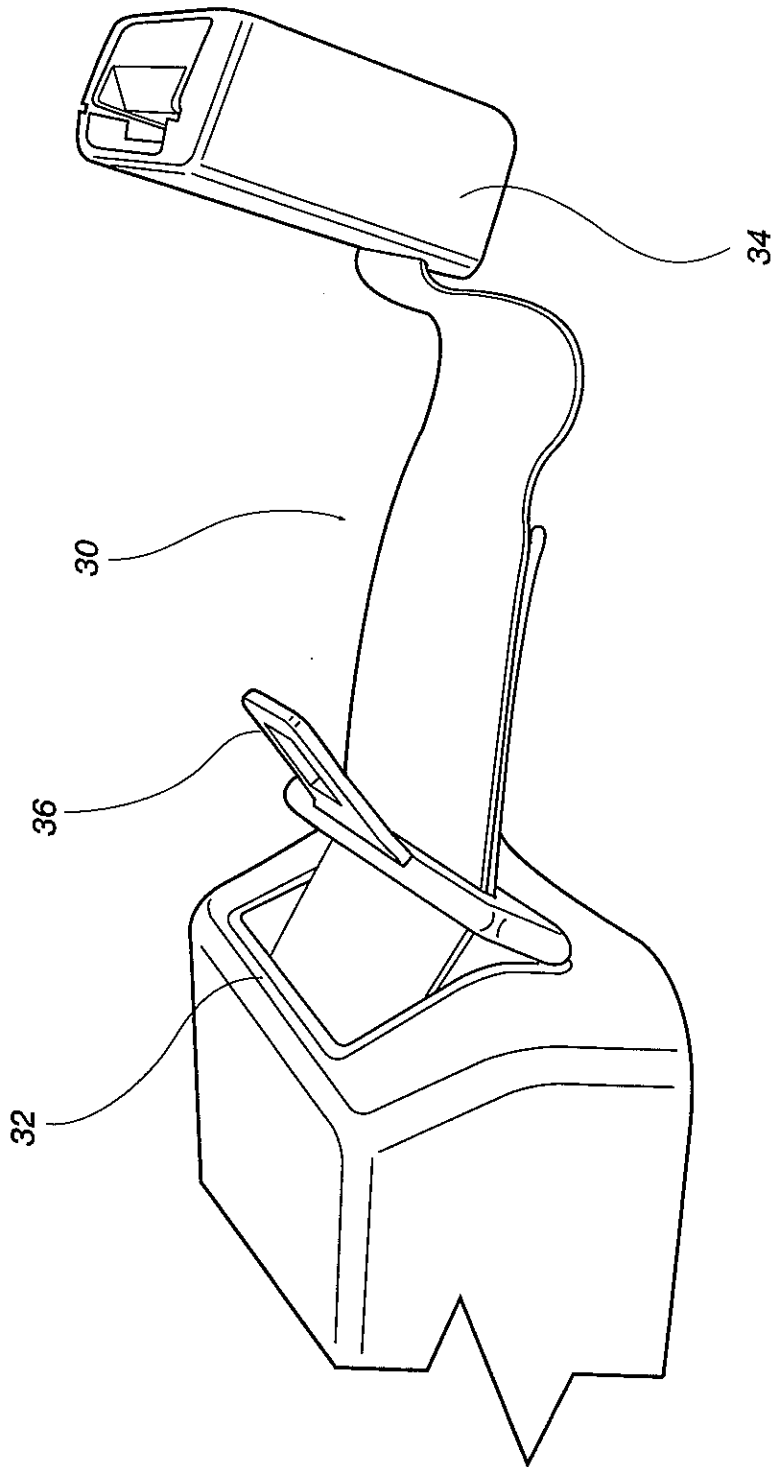
**Fig 3**



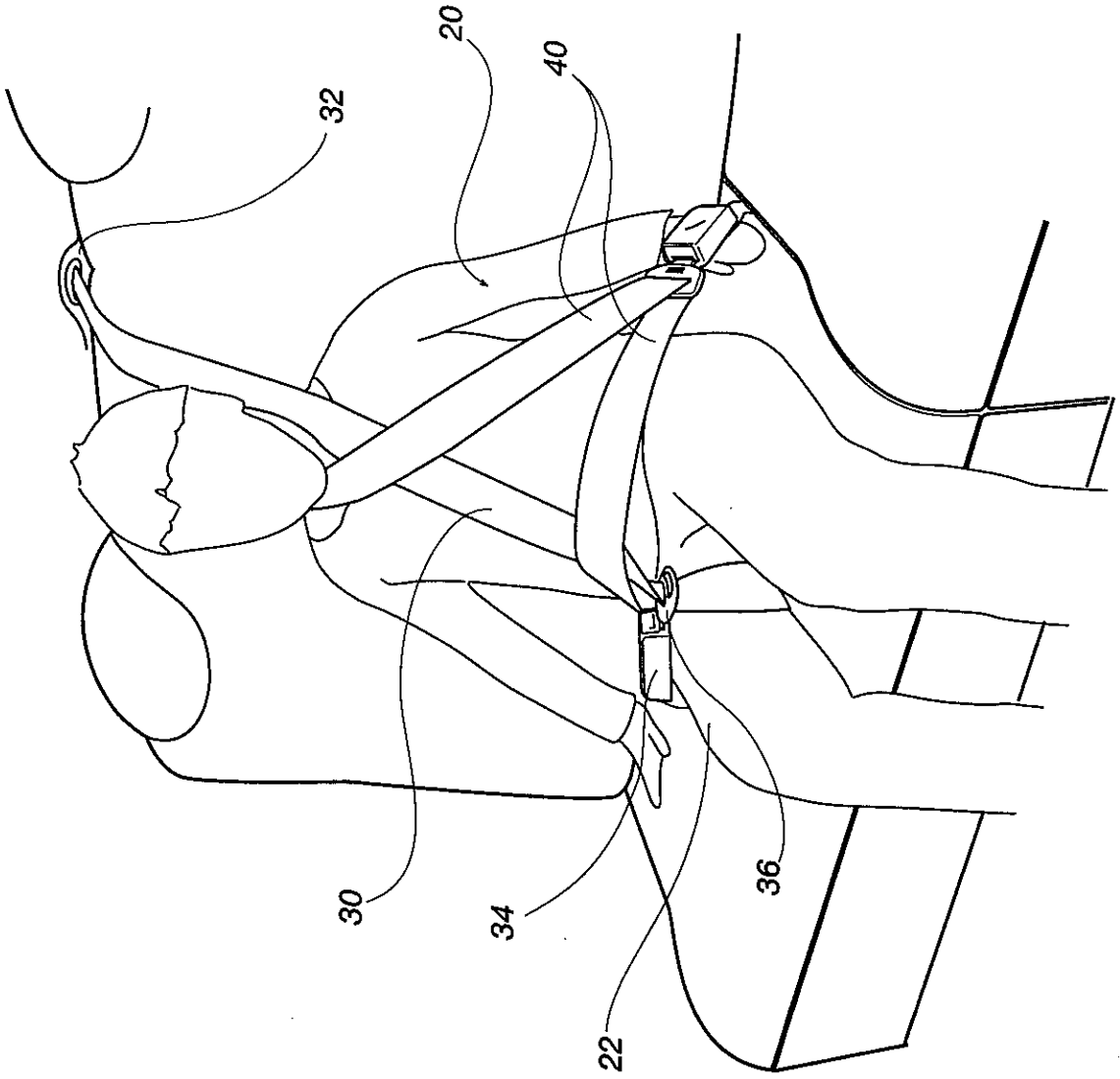
**Fig 4**



**Fig 5**



**Fig 6**



**Fig 7**

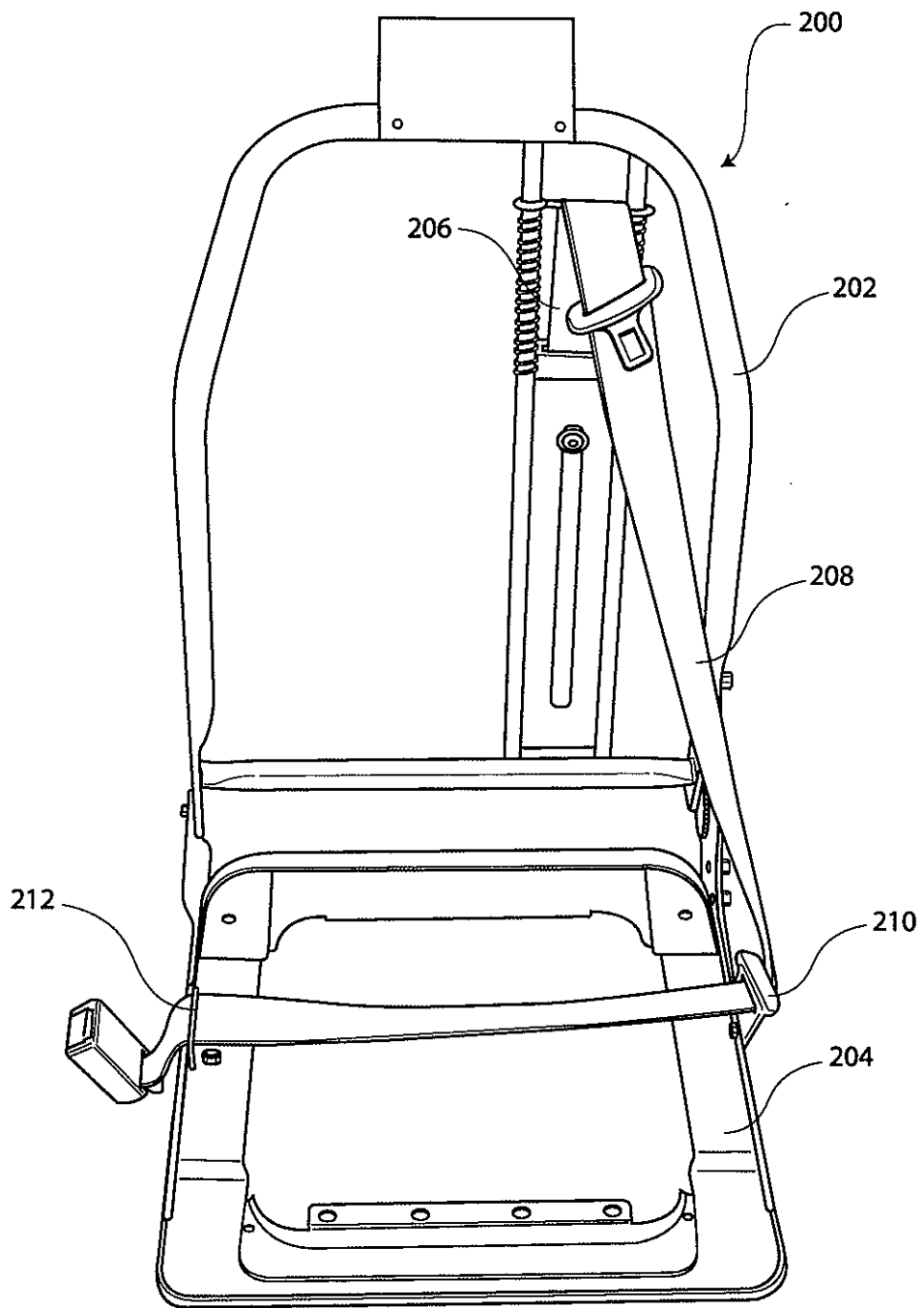


Figure 8

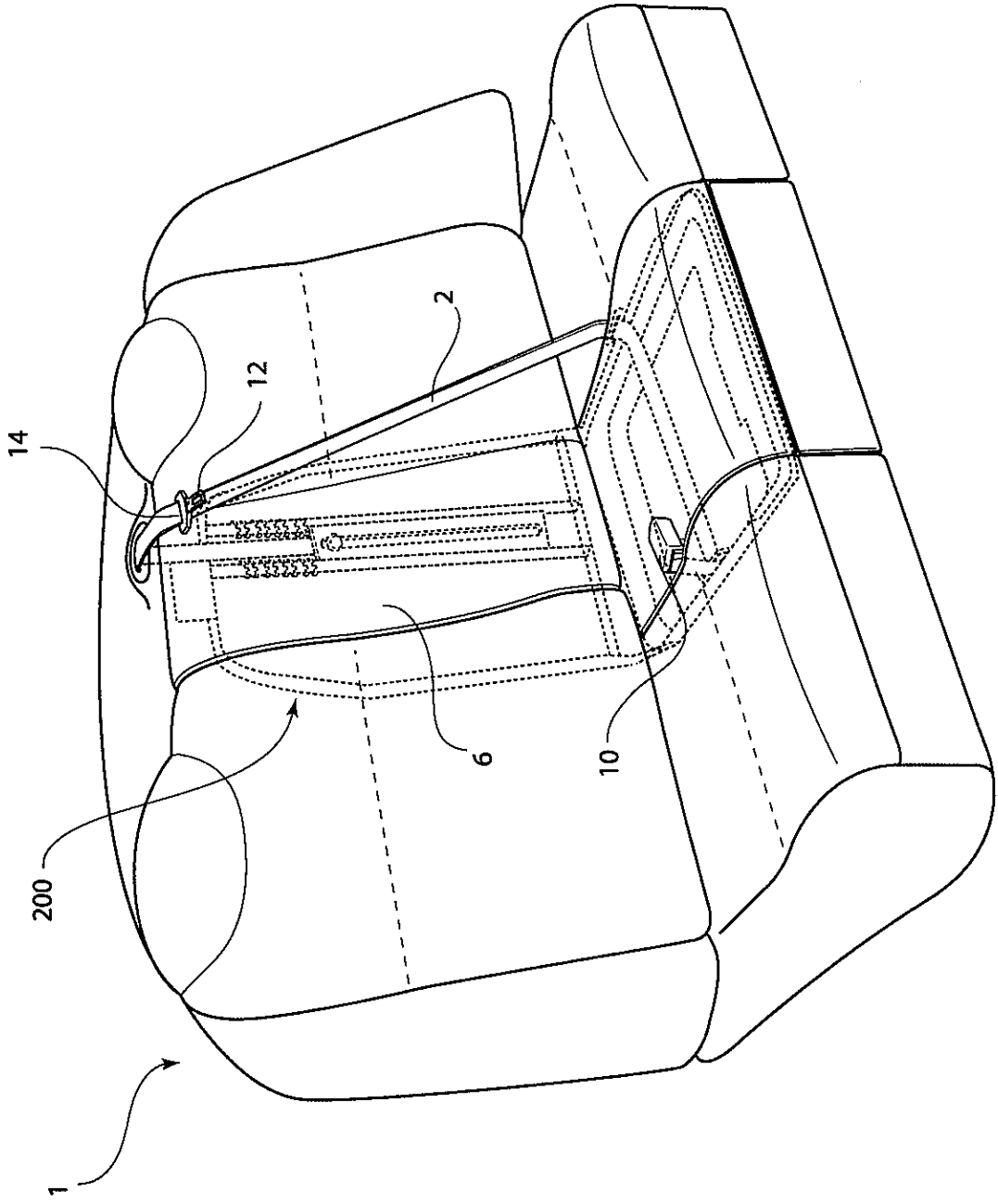


Figure 9



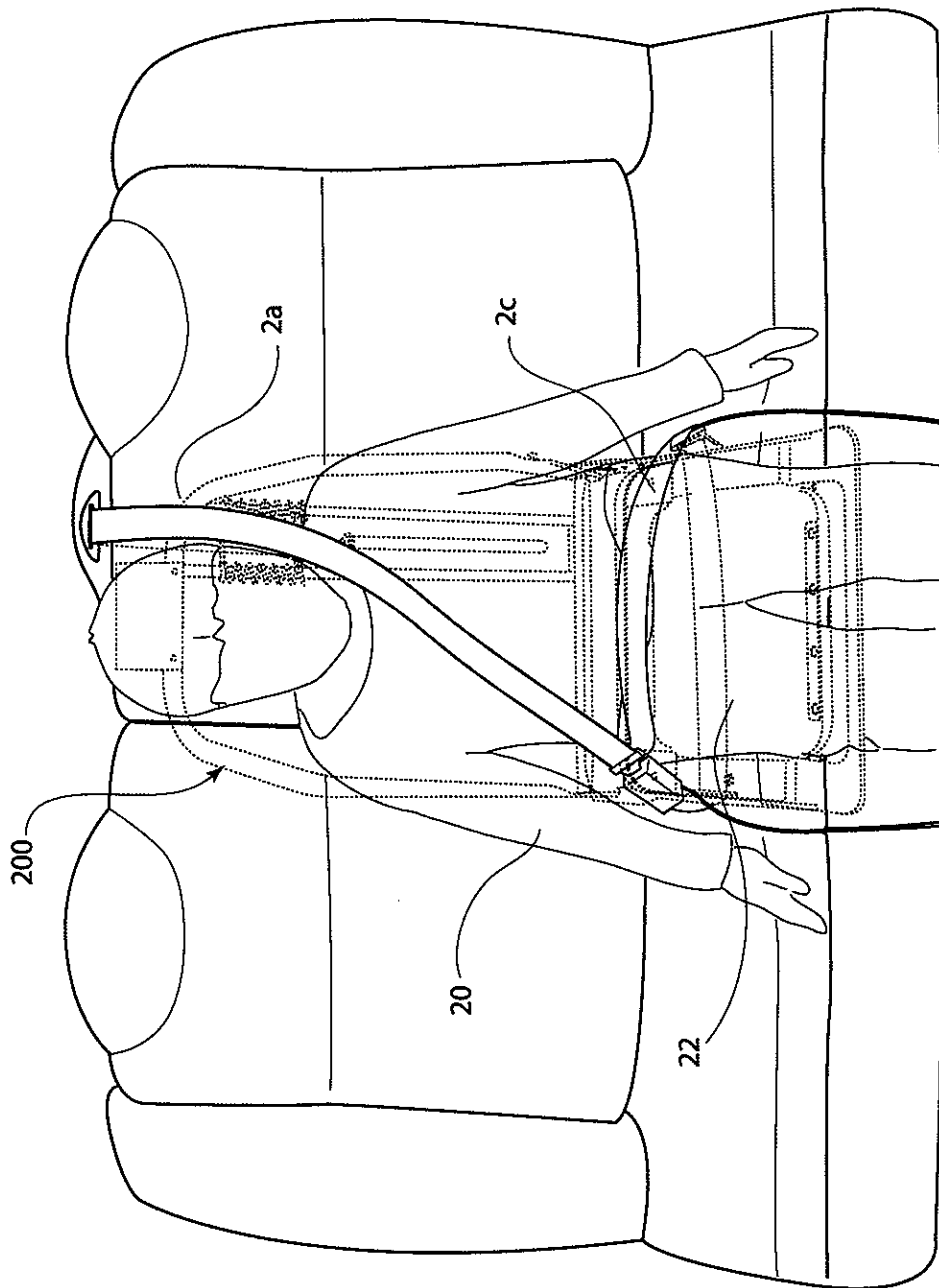


Figure 10

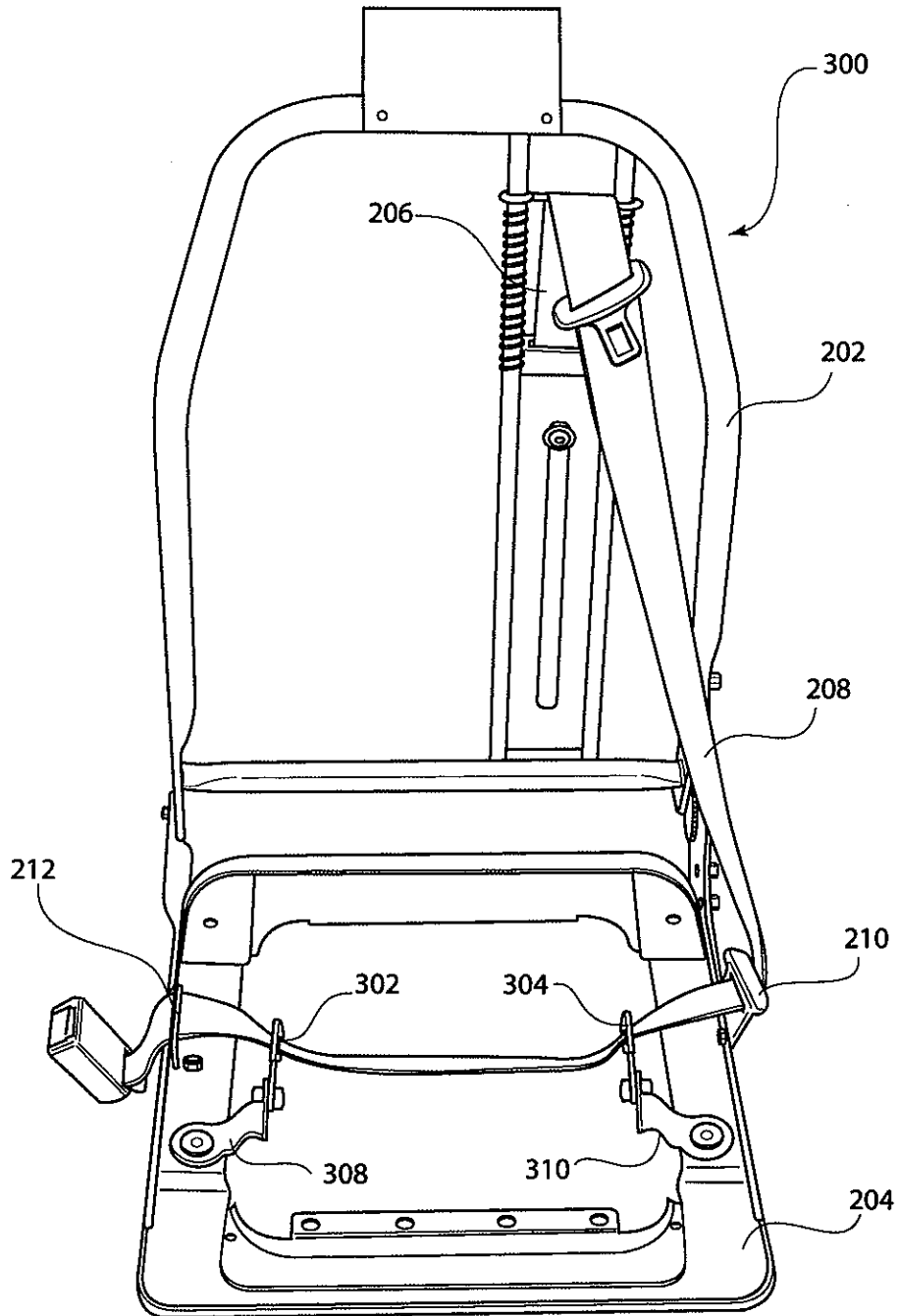


Figure 11

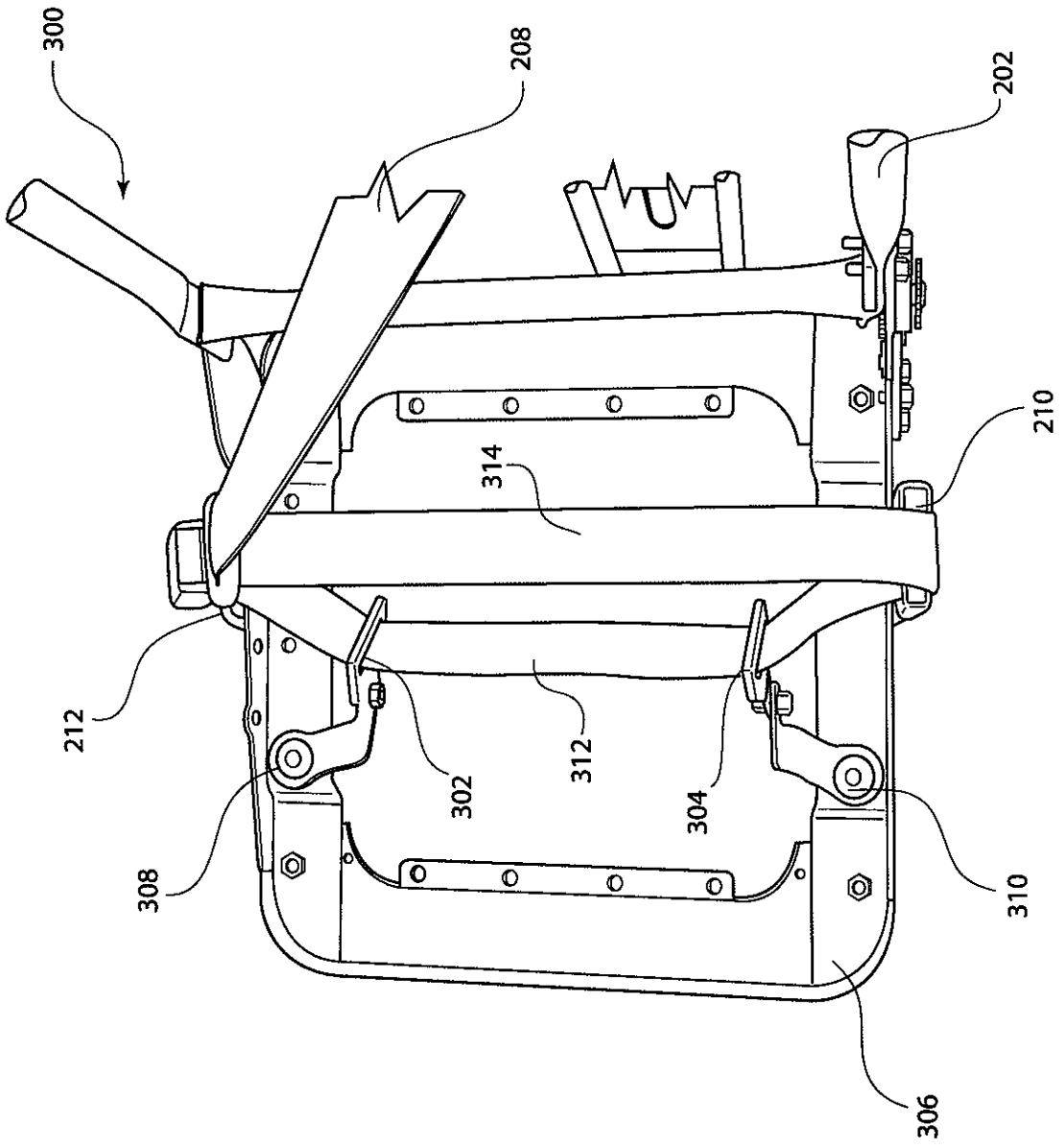


Figure 12