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(54) PERSONNEL PROTECTIVE ARRANGEMENT

PERSONENSCHUTZANORDNUNG

DISPOSITIF DE PROTECTION PERSONNEL

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Description

' FIELD OF THE INVENTION

[0001] This invention relates to an arrangement for protecting personnel seated inside of a combat vehicle, and more particularly, to such an arrangement that protects against the deleterious effects of land mine detonations.

BACKGROUND

[0002] Land combat vehicles, such as armored personnel carriers, for example, are intended for use in a hostile environment, and must be designed to counter various threats expected to be encountered when deployed in such an environment. One such threat is the detonation of a land mine under the vehicle. The force of the exploding land mine is primarily directed upward against the bottom of the vehicle.

[0003] Armored personnel carriers (APCs) generally transport infantry soldiers in addition to the crew of the vehicle. The armored vehicle speeds the movement of the soldiers to the area of their deployment and provides protection for the soldiers from attacks that may be made by snipers, aircraft, mines and the use of improvised explosive devices.

[0004] Land mines include antipersonnel mines and antiarmor mines such as antitank mines. Antipersonnel mines generally utilize a relatively small explosive charge. An armored land combat vehicle is typically minimally affected by an encounter with an antipersonnel mine because of the large mass of the armored vehicle, its armored protection and the relatively small explosive force delivered by the antipersonnel mine. Antiarmor or antitank mines contain a much more powerful explosive charge that is often shaped to direct the greatest force of the explosion upwards toward the bottom of a passing vehicle.

[0005] Thus, it is important to provide substantial protection to the underside of armored combat vehicles to minimize injury to the vehicle's occupants. Armored personnel carriers have long been provided with an exterior armored bottom plate with a floor plate rigidly secured to and supported by the inner side of the bottom plate. The bottom plate is made to resist penetration, thereby protecting personnel inside from being injured or killed by shrapnel resulting from the explosion.

[0006] However, the bottom plate is deformable by the force of an explosion, with explosive force being transferred to personnel seated within the APC. Explosive energy that is applied to the bottom plate of the APC is substantially transmitted through the bottom plate to the floor plate and thus to the seats and the personnel that are seated in them within the vehicle. The abrupt, upwardly directed, acceleration that results to the personnel can cause considerable bodily harm even though the personnel are shielded from the direct force of the explosion and shrapnel that may result. The vertebrae of the back and neck are often particularly vulnerable to injury. This problem has been partially addressed by utilizing seats with a yieldable suspension to absorb most of the shock. While such an arrangement provides some protection, the lower extremities remain especially vulnerable to injury.

[0007] An exemplary energy attenuation system utilized in seats includes a seat supported by two vertical rails. The seat includes two hardened cutters. The cutters pass through a channel formed from light alloy material. Shear pins with a predetermined shear value support the seat under normal circumstances. If the seat and a person seated in it are subjected to upward acceleration in excess of the predetermined load the shear pins shear and the cutters are forced to cut through the channels and dissipate energy thus keeping the acceleration load on the seat occupant below predetermined limits. Another example of an acceleration attenuation system is provided in US3,446,469, which forms a starting point for the independent claims 1 and 12 and which describes a platform for carrying personnel or equipment, supported by two panel-form torsionally stiff scissor elements. The scissor elements have a central hinge and upright crushable, disposable supports at either end. The scissor elements are mounted on a base member, along which the elements may slide in the event of a shock loading. Other acceleration attenuation systems exist and are specifically contemplated to fall within the scope of the invention.

[0008] When acceleration attenuation seats are used the seat's supporting carriage collapses or telescopes in a controlled manner to absorb energy that otherwise would be applied to the occupant's body. As the carriage collapses the seat bucket moves toward the supporting floor.

[0009] Thus the acceleration attenuating seat protects the occupant's vertebral column but the feet that rest on the floor and the legs may still be subject to unacceptable levels of acceleration.

[0010] The military arts would benefit from a way to further protect the occupants of armored vehicles from injury caused by explosions that occur beneath the vehicle. It would be especially beneficial to provide protection from injuries to the lower extremities.

SUMMARY OF THE INVENTION

[0011] The present invention in accordance with independent claims 1 and 12 overcomes many of the deficiencies of the prior art by supporting a floor plate and a seat plate on energy absorbing members secured to the bottom plate of the vehicle. These support members are plastically deformable in a predetermined and predicable manner under the forces imposed by a land mine exploding under the vehicle. Since much of the energy of the shock load imposed by the explosion is dissipated by the plastic deformation of the support members, the possi-

bility of injury to personnel inside the vehicle is reduced, particularly injury to the lower extremities. In addition, a commercial off the shelf acceleration attenuating seat is mounted on a seat plate that rests upon crushable members to enhance the seat effectiveness and to attenuate acceleration beyond what the seat alone is capable of.

[0012] In operation, when an explosive force is applied to the bottom plate, the bottom plate deforms upwardly. As the bottom plate deforms upwardly, the energy absorbing members are crushed or deformed and dissipate some of the energy that would otherwise be transferred to the floor plate and the seat plate. The various energy absorbing members are designed so that the seats and the floor plate accelerate at a substantially similar rate that is maintained at a level that minimizes injury to the seat occupants and prevents the legs from being subjected to acceleration substantially greater than the rest of the occupants body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a cross sectional view taken generally along the centerline of a portion of an armored personnel carrier incorporating the present invention;

Fig. 2 is a top plan view of the vehicle shown in Fig. 1 with portions of the top thereof broken away to show the floor and seats in the interior;

Fig. 3 is a view similar to Fig. 2 but with the seats and floor eliminated to show the plastically deformable members;

Fig. 4 is an orthographic view of the vehicle as shown in Fig. 3;

Fig. 5 is a cross-sectional view taken on line 5-5 of Fig. 3;

Fig 6. is a cross-sectional view taken on line 6-6 of Fig. 3; and

Fig. 7 is a cross-sectional view taken on line 7-7 of Fig. 6.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Referring to Figs. 1-4, there is shown a portion of an armored personnel carrier, indicated generally at 10, having a conventional hull 12 including a bottom plate 14. A floor plate 16 is supported above the bottom plate 14 by a plurality of plastically deformable members, which members will be more fully described hereinafter. Bottom plate 14 is formed of a heavy armor plate that is particularly adapted to resist penetration from the force of explosions that may be applied to the outer surface of bottom plate 14. Floor plate 16 is substantially lighter material such as aluminum plate with diamond tread texturing embossed thereon to improve traction on the surface.

[0015] A plurality of conventional off the shelf seats 18, each of which includes a suspension system 20 for attenuation of acceleration, are arranged in back to back rows and attached to a platform 22. The platform 22 is secured to a seat plate 24, which rests upon a plurality of crushable members 26, as depicted in Fig. 4. The crushable members 26 are formed of a material, such as wrought aluminum alloy, that is sufficiently rigid to normally support the seat plate 24, seats 18 and seat occupants. Crushable members 26 are plastically deformed by and collapse under the force of a mine exploding underneath the bottom plate 14.

[0016] The seat plate 24 is provided with a thickness similar to that of the bottom plate 14 so that it is relatively rigid. The rigidity of the seat plate 24 assures that the load is spread relatively evenly among the members 26 so that the seats 18 will move vertically as a unit, and in unison with the floor plate 16. Seat plate 24 is located in a cutout in floor plate 16 so that floor plate 16 surrounds seat plate 24.

[0017] Injury to seated personnel, particularly to the legs, is minimized when the vertical acceleration of the floor plate 16 is substantially equal to the vertical acceleration of the seats 18. The rigidity of the seat plate 24 assures the seats 18 move as a unit, and thus with a substantially uniform vertical acceleration. The crushable members 26 and the deformable floor support members, as described below, are designed to plastically yield at substantially the same load so that the vertical accelerations of the floor plate 16 and of the seat plate 24 are substantially the same.

[0018] The asymmetrical arrangement of the crushable members 26 is allowable, if necessary, to provide clearance for a plurality of components, such as hydraulic hoses and electrical conduits, that may be routed through the space between the bottom plate 14 and the seat plate 24.

[0019] The deformable floor support members include three basic types. As shown in Fig. 5, one type of support member is shown at 28. The lower end 30 of sigmoid support member 28 is welded or otherwise secured to the bottom plate 14. The floor plate 16 rests upon, but is not secured to the upper end 32. A rubber pad 34 is interposed between the floor plate 14 and the upper end 32 to eliminate noise, such as rattles and squeaks, that may otherwise occur as a result of relative movement therebetween. Rubber pad 34 may also be interposed between lower end 30 and bottom plate 14 if upper end 32 is secured to floor plate 14. Because the upper end 32 is laterally offset from the lower end 30 and because the upper end 32 may move laterally relative to the floor plate 16, the sigmoid support member 28 is essentially a cantilever beam in bending and will readily deform plastically but only when subjected to the forces of an exploding land mine.

[0020] A second type of deformable support member is shown at 36 in Fig. 5. Hat channel support member 36 presents lower ends 38 and 40. Each of lower ends 38 and 40 of the hat channel support member 36 is welded or otherwise secured to the bottom plate 14. A rubber

pad 42 is also interposed between the lower surface of the floor plate 16 and the middle portion 44 of the hat channel support member 36 to eliminate noise. The middle portion 44 is laterally offset from both of the lower ends 38 and 40. When subjected to the forces created by an exploding land mine, hat channel support member 36 will plastically deform by buckling.

[0021] The third type of plastically deformable member 46 is shown in Fig. 6., and is similar to the sigmoid member 28 in its manner of failure, i.e. its plastic deformation under load. However, the securing member 46 also serves to properly locate the floor plate 16 relative to the interior of the vehicle and to secure the floor plate 16 from upward movement. The lower end 48 of securing member 46 is welded or otherwise secured to the bottom plate 14. The upper end 50 is laterally offset from the lower end 48 with a weld nut 52 affixed to the underside of and aligned with a hole 54 formed in the upper end 50.

[0022] A rubber pad 56, also provided with a hole 58, is interposed between the lower surface of the floor plate 16 and the upper surface of upper end 50. A bolt 60 extends through a washer 62 and an enlarged hole in the floor plate 16 to threadedly engage the nut 52. A rubber washer 64 is interposed between the washer 62 and the floor plate 16 to limit abrasion and noise. Securing members 46 are generally arranged around the periphery of the floor plate 16, and around the periphery of the seat plate 24 to locate and secure floor plate 16 and seat plate 24.

[0023] In operation, when an explosive force is applied to bottom plate 14, bottom plate 14 deforms upwardly. As the bottom plate 14 deforms upwardly, crushable members 26, sigmoid support member 28, hat channel support members 36 and securing members 46 are crushed or deformed and dissipate some of the energy that would otherwise be transferred to the floor plate 16 and the seat plate 24. The various energy absorbing members are designed so that the seats 18 and the floor plate 16 accelerate at a substantially similar rate that is maintained at a level that minimizes injury to the seat occupants and prevents the legs from being subjected to acceleration substantially greater than the rest of the occupants body thus minimizing injury to the occupants. This arrangement especially minimizes injury to the lower extremities.

Claims

1. An armored land vehicle (10) adapted to protect occupants from force of an explosion detonated beneath the vehicle, the vehicle comprising:

   a bottom plate (14), said bottom plate resistant to penetration by explosive shrapnel;
   a floor plate (16) covering a first portion of the bottom plate, said floor plate located substantially above and spaced from the bottom plate;
   a seat plate (24) covering a second portion of the bottom plate, said seat plate located substantially above and spaced from the bottom plate;
   energy absorbing members interposed between the bottom plate and the floor plate, and between the bottom plate and the seat plate;
   and at least one seat (18) supported by acceleration attenuating suspension supports attached to the seat plate.

2. The armored land vehicle as claimed in claim 1, in which the energy absorbing members comprise crushable members (26) and floor support members, said crushable members and floor support members being designed to plastically yield at substantially the same load.

3. The armored land vehicle as claimed in claim 2, in which the crushable members (26) are substantially C-shaped.

4. The armored land vehicle as claimed in claim 2, in which the floor support members comprise deformable substantially sigmoid shaped members (28).

5. The armored land vehicle as claimed in claim 2, in which the floor support members comprise deformable substantially sigmoid shaped members secured to the floor plate (16) or the seat plate (24) to hold down the floor plate or the seat plate.

6. The armored land vehicle as claimed in claim 2, in which the floor support members comprise deformable substantially hat shaped members (36).

7. The armored land vehicle as claimed in claim 1, further comprising resilient rubber pads (34,42,56) which isolate the energy absorbing members from either the bottom plate or the floor plate.

8. The armored land vehicle as claimed in claim 1, in which the energy absorbing members are formed from wrought aluminum alloy.

9. The armored land vehicle as claimed in claim 1, in which acceleration of the seat plate (24) and the floor plate (16) caused by an explosion are substantially the same whereby injury to seated occupants is minimized.

10. The armored land vehicle as claimed in claim 1, in which the energy absorbing members comprise crushable members.

11. The armored land vehicle as claimed in claim 1, in which the seat plate and the bottom plate have substantially equal thickness.

12. A method of protecting the occupants of an armored vehicle (10) from injury caused by an explosion beneath the vehicle, the vehicle comprising a bottom plate (14), said bottom plate resistant to penetration by explosive shrapnel, the method comprising the steps of:

covering a first portion of the bottom plate with a floor plate (16), said floor plate located substantially above and spaced from the bottom plate;
covering a second portion of the bottom plate with a seat plate (24), said seat plate located substantially above and spaced from the bottom plate;
interposing energy absorbing members between the bottom plate and the floor plate, and between the bottom plate and the seat plate;
and attaching at least one seat supported by acceleration attenuating suspension supports (20) to the seat plate.

13. The method as claimed in claim 12, wherein the energy absorbing members include crushable members (26) and floor support members, said crushable members and floor support members being designed to plastically yield at substantially the same load.

14. The method as claimed in claim 13, further comprising the step of forming the crushable members to be substantially C-shaped.

15. The method as claimed in claim 13, further comprising the step of forming the floor support members to be substantially sigmoid shaped and deformable.

16. The method as claimed in claim 13, further comprising the step of securing the floor support members to the seat plate (24) to hold down the seat plate.

17. The method as claimed in claim 13, further comprising the step of securing the floor support members to the floor plate (16) to hold down the floor plate.

18. The method as claimed in claim 13, further comprising the step of forming the floor support members to be substantially hat shaped and deformable.

19. The method as claimed in claim 13, further comprising the step of interposing resilient rubber pads which isolate the energy absorbing members between the energy absorbing members and either the bottom plate or the floor plate.

20. The method as claimed in claim 13, further comprising the step of forming the energy absorbing members from wrought aluminum alloy.

21. The method as claimed in claim 13, further comprising the step of forming the energy absorbing members such that acceleration of the seat plate and the floor plate caused by an explosion are substantially the same whereby injury to seated occupants is minimized.

22. The method as claimed in claim 13, further comprising the step of forming the seat plate and the bottom plate to have substantially equal thickness.

Patentansprüche

1. Gepanzertes Landfahrzeug (10), das eingerichtet ist, Insassen vor der Kraft einer unter dem Fahrzeug zur Detonation gebrachten Explosion zu schützen, welches Fahrzeug aufweist:

eine Unterplatte (14), wobei die Unterplatte widerstandsfähig gegen das Eindringen einer explosiven Schrapnellladung ist;
eine einen ersten Teil der Unterplatte abdeckende Bodenplatte (16), wobei die Bodenplatte im Wesentlichen über der Unterplatte und in einem Abstand von dieser angeordnet ist;
eine einen zweiten Teil der Unterplatte abdekkende Sitzplatte (24), wobei die Sitzplatte im Wesentlichen über der Unterplatte und in einem Abstand von dieser angeordnet ist;
energieabsorbierende Elemente, die zwischen der Unterplatte und der Bodenplatte sowie zwischen der Unterplatte und der Sitzplatte angeordnet sind; und
mindestens einen Sitz (18), der von beschleunigungsdämpfenden Schwebestützen getragen ist, welche an der Sitzplatte angebracht sind.

2. Gepanzertes Landfahrzeug nach Anspruch 1, bei welchem die energieabsorbierenden Elemente Knautschelemente (26) und Bodenstützelemente aufweisen, wobei die Knautschelemente (26) und die Bodenstützelemente ausgelegt sind, bei im Wesentlichen derselben Belastung plastisch nachzugeben.

3. Gepanzertes Landfahrzeug nach Anspruch 2, bei welchem die Knautschelemente (26) im Wesentlichen C-förmig sind.

4. Gepanzertes Landfahrzeug nach Anspruch 2, bei welchem die Bodenstützelemente verformbare, im Wesentlichen S-förmige Elemente (28) aufweisen.

5. Gepanzertes Landfahrzeug nach Anspruch 2, bei welchem die Bodenstützelemente verformbare, im Wesentlichen S-förmige Elemente aufweisen, die an der Bodenplatte (16) oder an der Sitzplatte (24) be-

festigt sind, um die Bodenplatte bzw. die Sitzplatte niederzuhalten.

6. Gepanzertes Landfahrzeug nach Anspruch 2, bei welchem die Bodenstützelemente verformbare, im Wesentlichen haubenförmige Elemente (36) aufweisen.

7. Gepanzertes Landfahrzeug nach Anspruch 1, weiters mit nachgiebigen Gummikissen (34, 42, 56) zur Trennung der energieabsorbierenden Elemente von der Unterplatte oder von der Bodenplatte.

8. Gepanzertes Landfahrzeug nach Anspruch 1, bei welchem die energieabsorbierenden Elemente aus einer geschmiedeten Aluminiumlegierung gebildet sind.

9. Gepanzertes Landfahrzeug nach Anspruch 1, bei welchem die durch eine Explosion verursachte Beschleunigung der Sitzplatte (24) und der Bodenplatte (16) im Wesentlichen dieselbe ist, wodurch eine Verletzung der sitzenden Insassen minimiert wird.

10. Gepanzertes Landfahrzeug nach Anspruch 1, bei welchem die energieabsorbierenden Elemente Knautschelemente aufweisen.

11. Gepanzertes Landfahrzeug nach Anspruch 1, bei welchem die Sitzplatte und die Unterplatte im Wesentlichen die gleiche Dicke aufweisen.

12. Verfahren zum Schützen der Insassen eines gepanzerten Fahrzeugs (10) vor einer durch eine Explosion unter dem Fahrzeug verursachten Verletzung, wobei das Fahrzeug eine Unterplatte (14) aufweist und die Unterplatte gegen das Eindringen einer explosiven Schrapnellladung widerstandsfähig ist, welches Verfahren die folgenden Schritte umfasst:

Abdecken eines ersten Teils der Unterplatte mit einer Bodenplatte (16), wobei die Bodenplatte im Wesentlichen über der Unterplatte und in einem Abstand von dieser angeordnet ist;
Abdecken eines zweiten Teils der Unterplatte mit einer Sitzplatte (24), wobei die Sitzplatte im Wesentlichen über der Unterplatte und in einem Abstand von dieser angeordnet ist;
Anordnen von energieabsorbierenden Elementen zwischen der Unterplatte und der Bodenplatte sowie zwischen der Unterplatte und der Sitzplatte; und
Anbringen mindestens eines Sitzes (18), der von beschleunigungsdämpfenden Schwebestützen (20) getragen ist, an der Sitzplatte.

13. Verfahren nach Anspruch 12, wobei die energieabsorbierenden Elemente Knautschelemente (26) und Bodenstützelemente aufweisen, wobei die Knautschelemente und die Bodenstützelemente ausgelegt sind, bei im Wesentlichen derselben Belastung plastisch nachzugeben.

14. Verfahren nach Anspruch 13, weiters umfassend den Schritt des Formens der Knautschelemente als im Wesentlichen C-förmige Elemente.

15. Verfahren nach Anspruch 13, weiters umfassend den Schritt des Formens der Bodenstützelemente als im Wesentlichen S-förmige und verformbare Elemente.

16. Verfahren nach Anspruch 13, weiters umfassend den Schritt des Befestigens der Bodenstützelemente an der Sitzplatte (24) zum Niederhalten der Sitzplatte.

17. Verfahren nach Anspruch 13, weiters umfassend den Schritt des Befestigens der Bodenstützelemente an der Bodenplatte (16) zum Niederhalten der Bodenplatte.

18. Verfahren nach Anspruch 13, weiters umfassend den Schritt des Formens der Bodenstützelemente als im Wesentlichen haubenförmige und verformbare Elemente.

19. Verfahren nach Anspruch 13, weiters umfassend den Schritt des Anordnens von nachgiebigen Gummikissen, welche die energieabsorbierenden Elemente trennen, zwischen den energieabsorbierenden Elementen und entweder der Grundplatte oder der Bodenplatte.

20. Verfahren nach Anspruch 13, weiters umfassend den Schritt des Bildens der energieabsorbierenden Elemente aus einer geschmiedeten Aluminiumlegierung.

21. Verfahren nach Anspruch 13, weiters umfassend den Schritt des Bildens der energieabsorbierenden Elemente derart, dass die durch eine Explosion verursachte Beschleunigung der Sitzplatte und der Bodenplatte im Wesentlichen dieselbe ist, wodurch eine Verletzung der sitzenden Insassen minimiert wird.

22. Verfahren nach Anspruch 13, weiters umfassend den Schritt des Bildens der Sitzplatte und der Unterplatte mit im Wesentlichen gleicher Dicke.

Revendications

1. Véhicule terrestre blindé (10) adapté pour protéger ses occupants de la force d'une explosion déclen-

chée sous le véhicule, le véhicule comprenant :

une plaque de fond (14), ladite plaque de fond étant résistante à la pénétration d'éclats d'obus explosifs ;
une plaque de plancher (16) recouvrant une première portion de la plaque de fond, ladite plaque de plancher étant située sensiblement au-dessus et espacée de la plaque de fond ;
une plaque de siège (24) recouvrant une seconde portion de la plaque de fond, ladite plaque de siège étant située sensiblement au-dessus et espacée de la plaque de fond ;
des organes absorbeurs d'énergie interposés entre la plaque de fond et la plaque de plancher, et entre la plaque de fond et la plaque de siège ;
et au moins un siège (18) supporté par des supports à suspension atténuant l'accélération fixés sur la plaque de siège.

2. Véhicule terrestre blindé selon la revendication 1, dans lequel les organes absorbeurs d'énergie comprennent des organes écrasables (26) et des organes de support de plancher, lesdits organes écrasables et organes de support de plancher étant conçus pour se déformer plastiquement à sensiblement la même charge.

3. Véhicule terrestre blindé selon la revendication 2, dans lequel les organes écrasables (26) sont sensiblement en forme de C.

4. Véhicule terrestre blindé selon la revendication 2, dans lequel les organes de support de plancher comprennent des organes déformables de forme sensiblement sigmoïde (28).

5. Véhicule terrestre blindé selon la revendication 2, dans lequel les organes de support de plancher comprennent des organes déformables de forme sensiblement sigmoïde fixés sur la plaque de plancher (16) ou sur la plaque de siège (24) pour maintenir au sol la plaque de plancher ou la plaque de siège.

6. Véhicule terrestre blindé selon la revendication 2, dans lequel les organes de support de plancher comprennent des organes déformables en forme sensiblement de chapeau (36).

7. Véhicule terrestre blindé selon la revendication 1, comprenant en outre des coussins en caoutchouc résilient (34, 42, 56) qui isolent les organes absorbeurs d'énergie soit de la plaque de fond soit de la plaque de plancher.

8. Véhicule terrestre blindé selon la revendication 1, dans lequel les organes absorbeurs d'énergie sont formés à partir d'alliage d'aluminium travaillé.

9. Véhicule terrestre blindé selon la revendication 1, dans lequel l'accélération de la plaque de siège (24) et de la plaque de plancher (16) provoquée par une explosion est sensiblement la même moyennant quoi les blessures pour les occupants assis sont minimisées.

10. Véhicule terrestre blindé selon la revendication 1, dans lequel les organes absorbeurs d'énergie comprennent des organes écrasables.

11. Véhicule terrestre blindé selon la revendication 1, dans lequel la plaque de siège et la plaque de fond ont sensiblement la même épaisseur.

12. Procédé de protection des occupants d'un véhicule blindé (10) de blessures provoquées par une explosion sous le véhicule, le véhicule comprenant une plaque de fond (14), ladite plaque de fond étant résistante à la pénétration par des éclats d'obus explosifs, le procédé comprenant les étapes consistant à :

recouvrir une première portion de la plaque de fond d'une plaque de plancher (16), ladite plaque de plancher étant située sensiblement au-dessus et espacée de la plaque de fond ;
recouvrir une seconde portion de la plaque de fond d'une plaque de siège (24), ladite plaque de siège étant située sensiblement au-dessus et espacée de la plaque de fond ;
interposer des organes absorbeurs d'énergie entre la plaque de fond et la plaque de plancher, et entre la plaque de fond et la plaque de siège ;
et fixer au moins un siège supporté par des supports à suspension atténuant l'accélération (20) sur la plaque de siège.

13. Procédé selon la revendication 12, dans lequel les organes absorbeurs d'énergie comprennent des organes écrasables (26) et des organes de support de plancher, lesdits organes écrasables et organes de support de plancher étant conçus pour se déformer plastiquement à sensiblement la même charge.

14. Procédé selon la revendication 13, comprenant en outre l'étape de formation des organes écrasables pour qu'ils soient sensiblement en forme de C.

15. Procédé selon la revendication 13, comprenant en outre l'étape de formation des organes de support de plancher pour qu'ils soient de forme sensiblement sigmoïde et déformables.

16. Procédé selon la revendication 13, comprenant en outre l'étape de fixation des organes de support de plancher sur la plaque de siège (24) pour maintenir au sol la plaque de siège.

17. Procédé selon la revendication 13, comprenant en outre l'étape de fixation des organes de support de plancher sur la plaque de plancher (16) pour maintenir au sol la plaque de plancher.

18. Procédé selon la revendication 13, comprenant en outre l'étape de formation des organes de support de plancher pour qu'ils soient sensiblement en forme de chapeau et déformable.

19. Procédé selon la revendication 13, comprenant en outre l'étape d'interposition de coussins en caoutchouc résilient qui isolent les organes absorbeurs d'énergie entre les organes absorbeurs d'énergie et soit la plaque de fond, soit la plaque de plancher.

20. Procédé selon la revendication 13, comprenant en outre l'étape de formation des organes absorbeurs d'énergie à partir d'alliage d'aluminium travaillé.

21. Procédé selon la revendication 13, comprenant en outre l'étape de formation des organes absorbeurs d'énergie de telle sorte que l'accélération de la plaque de siège et la plaque de plancher provoquée par une explosion est sensiblement la même moyennant quoi les blessures pour les occupants assis sont minimisées.

22. Procédé selon la revendication 13, comprenant en outre l'étape de formation de la plaque de siège et de la plaque de fond pour qu'elles aient sensiblement la même épaisseur.

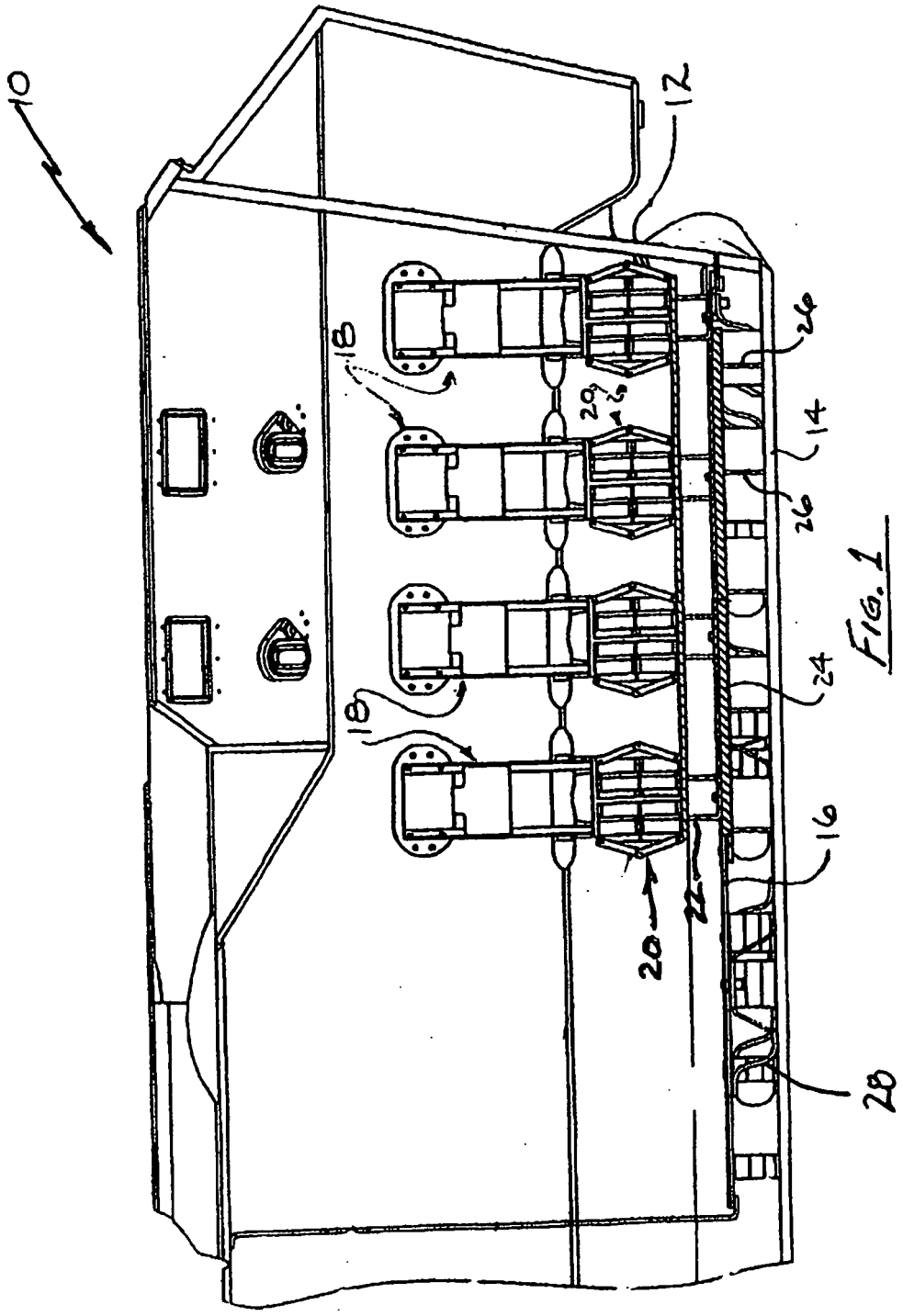


FIG. 1

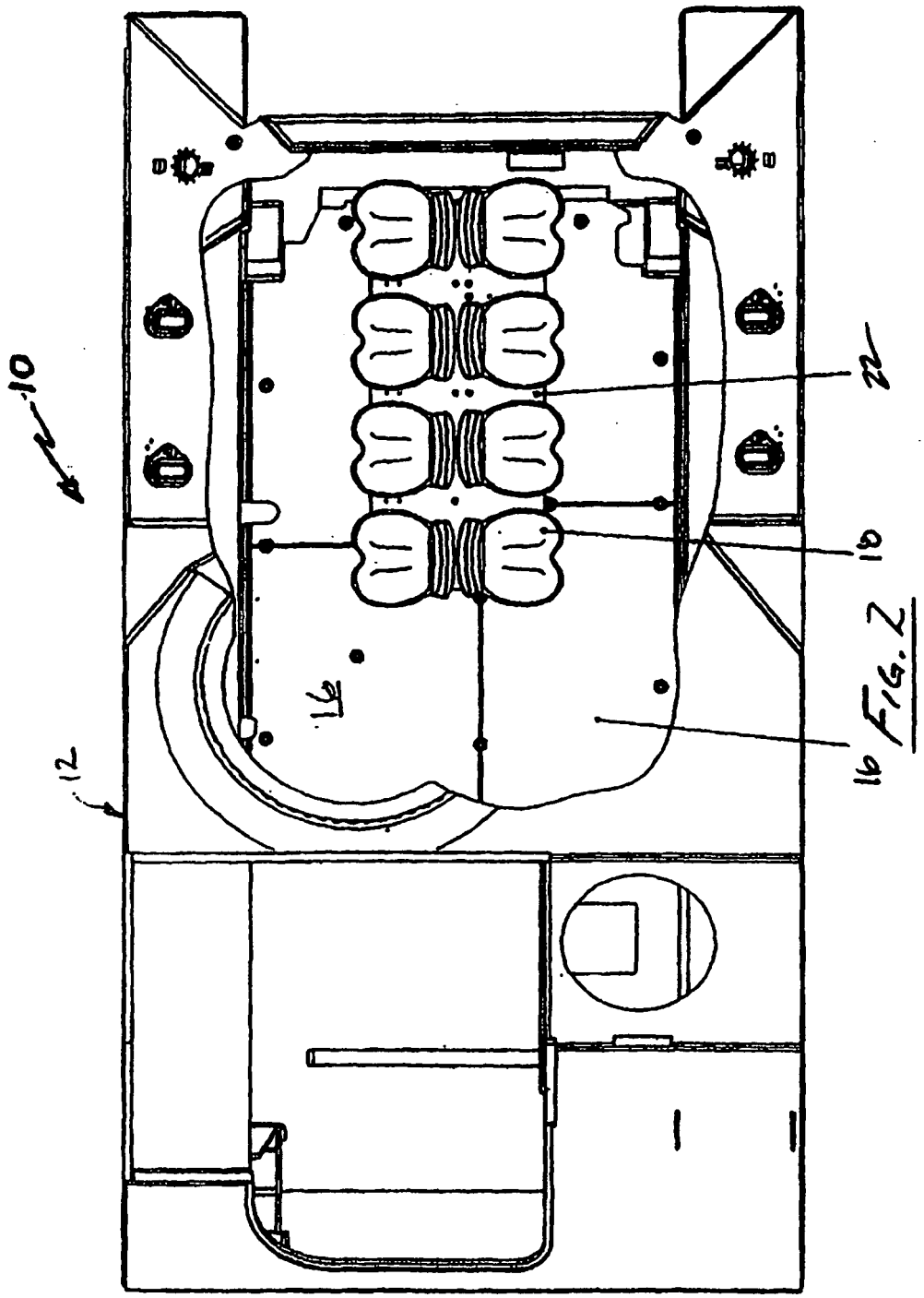


FIG. 2

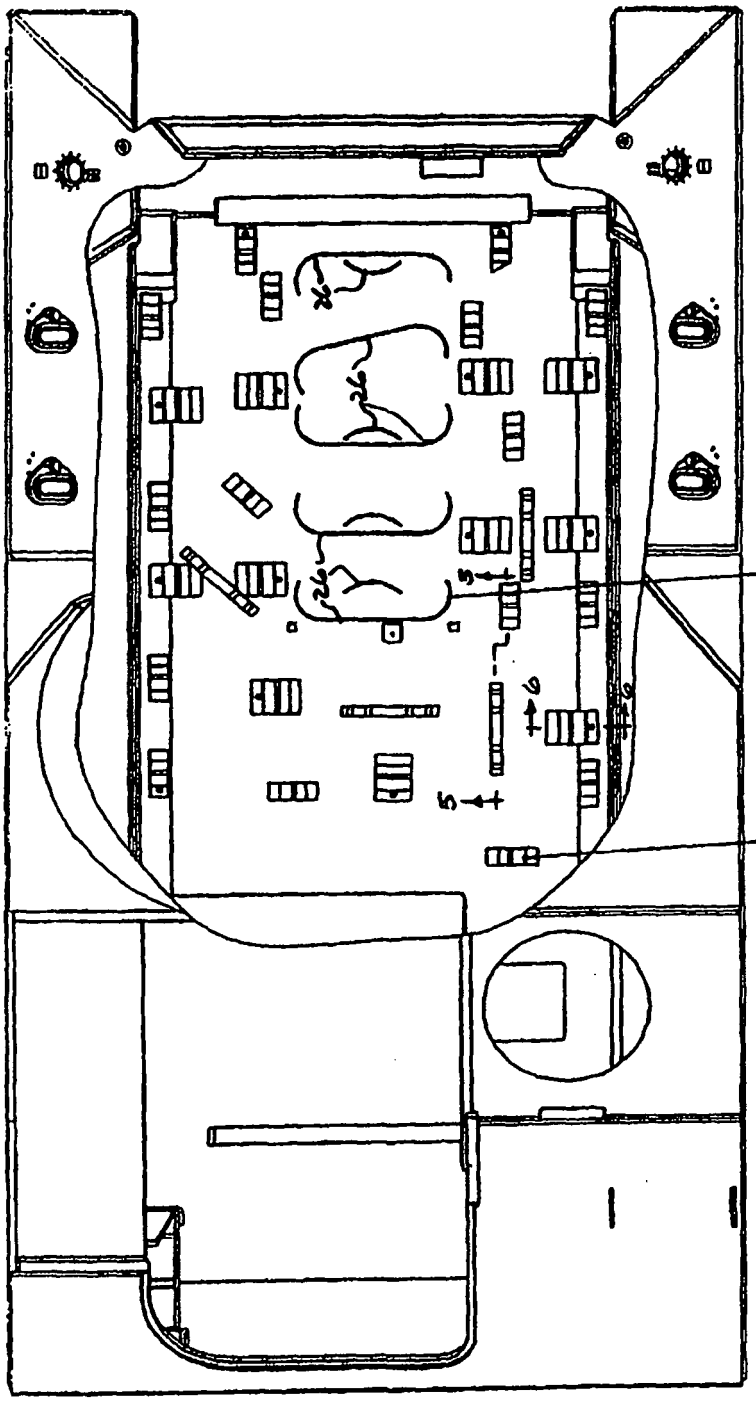


FIG. 3

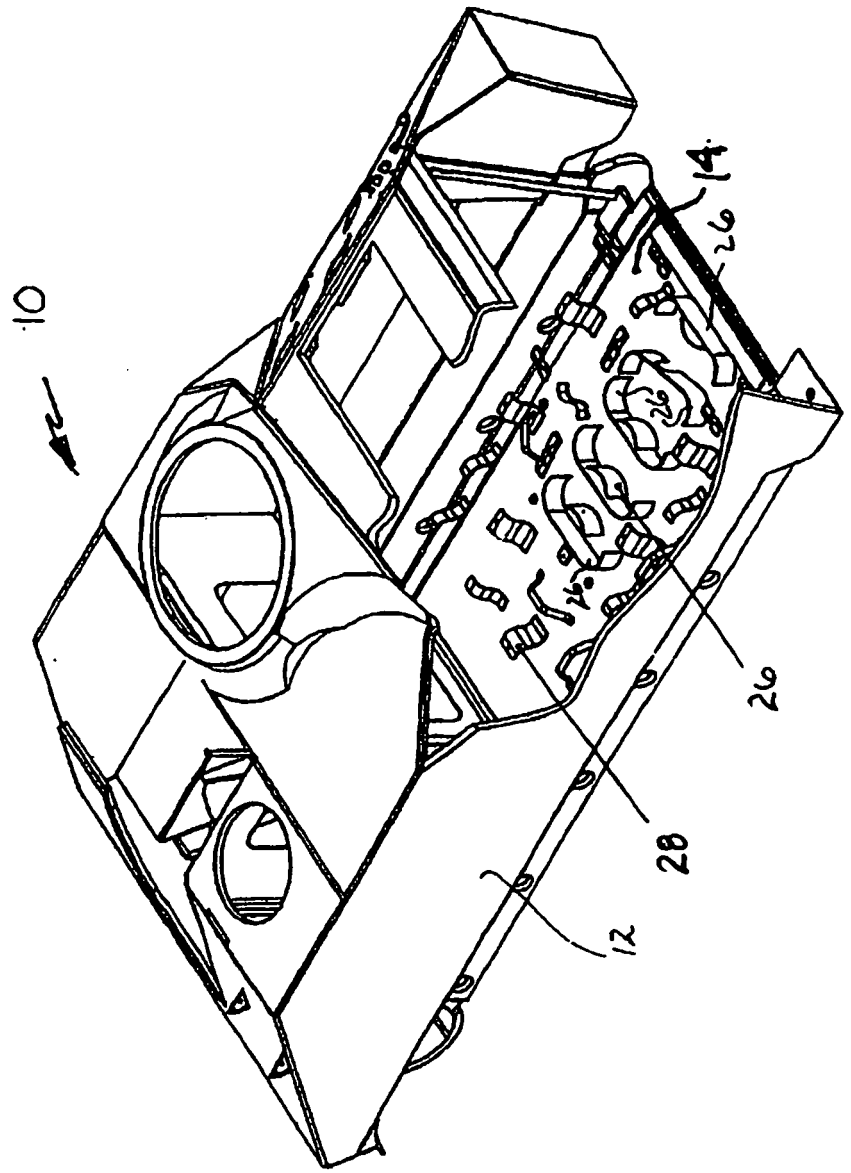


FIG. 4

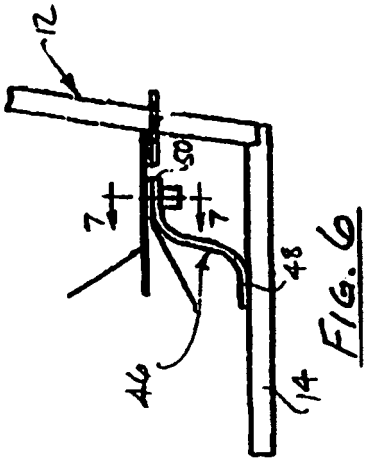


FIG. 6

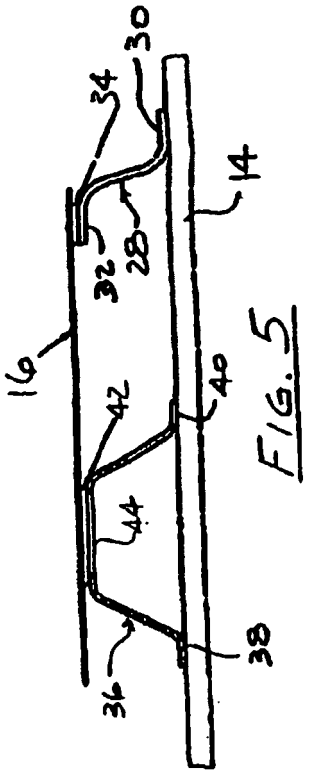


FIG. 5

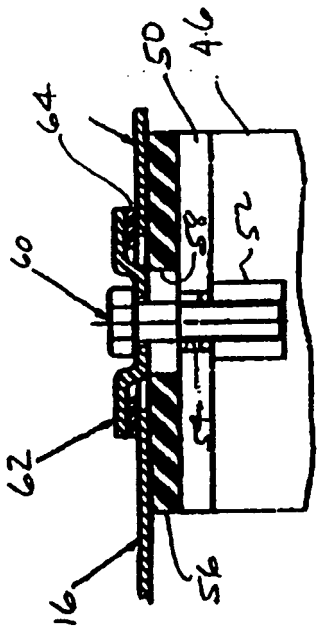


FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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