(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 235 482 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.10.2017 Bulletin 2017/43

(51) Int Cl.:
A61G 1/04 *(2006.01)* ***A61G 1/044*** *(2006.01)*
A61G 1/013 *(2006.01)*

(21) Application number: **16275060.8**

(22) Date of filing: **22.04.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **BAE Systems PLC**
London SW1Y 5AD (GB)

(72) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **BAE SYSTEMS plc**
Group IP Department
P.O. Box 87
Warwick House
Farnborough Aerospace Centre
Farnborough
Hampshire GU14 6YU (GB)

(54) **ARMOURED OCCUPANT RECOVERY**

(57) The following invention relates to armoured occupant recovery from an armoured land vehicle, and to an armoured flexible panel stretcher for occupant recovery from an armoured vehicle. There is provided an armoured flexible panel stretcher, comprising at least one armoured flexible panel, wherein said flexible panel comprises at least one fibrous armour material, encapsulated in a polymer binder matrix.

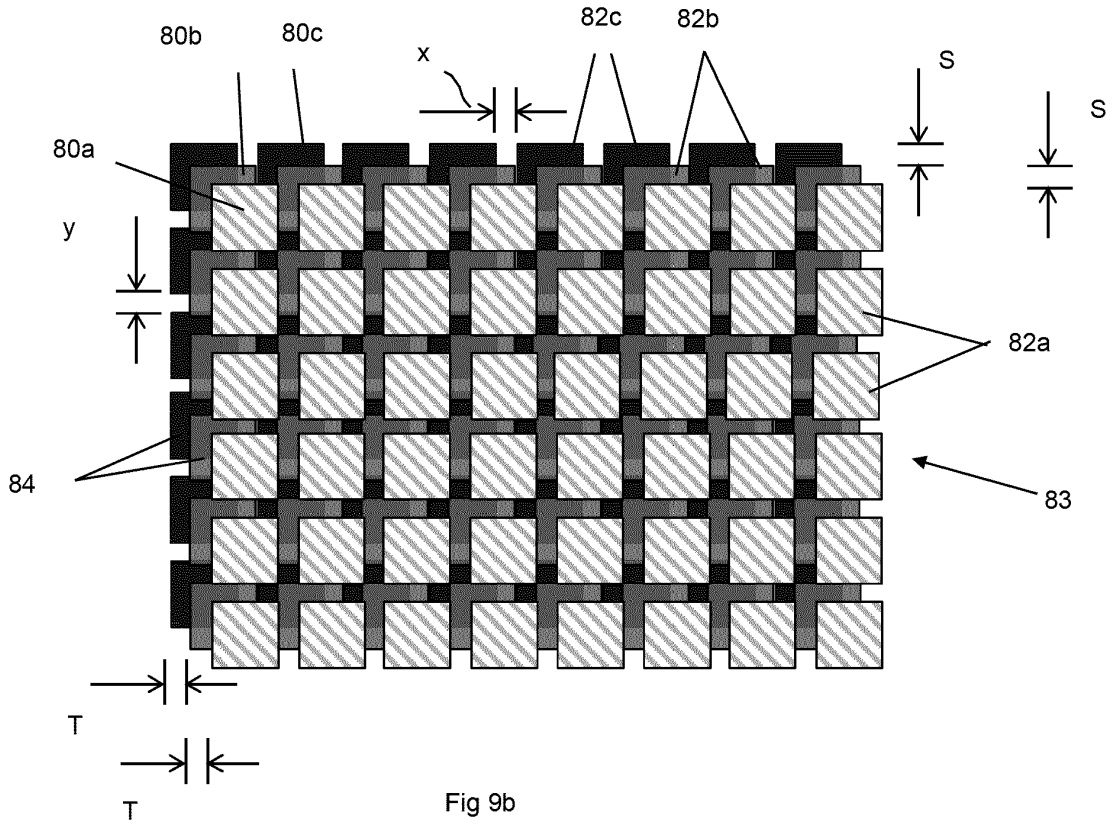


Fig 9b

EP 3 235 482 A1

Description

[0001] The following invention relates to armoured occupant recovery from an armoured land vehicle, and to an armoured flexible panel stretcher for occupant recovery from an armoured vehicle.

[0002] Before the present invention is described in further detail, it is to be understood that the invention is not limited to the particular embodiments described, as such may, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to be limiting, since the scope of the present invention will be limited only by the appended claims.

[0003] According to a first aspect of the invention there is provided a method of removing an occupant to be extracted from an armoured land vehicle comprising the steps of

deploying a flexible panel stretcher, locating the occupant in the flexible panel stretcher,

retaining the occupant within said flexible panel stretcher, manoeuvring the occupant via a labyrinthine path within said armoured land vehicle, to avoid one or more protruding features,

removing the occupant from an access point of the armoured land vehicle. The access point may be an egress point.

[0004] Preferably the flexible panel stretcher substantially encapsulates the occupant.

[0005] Occupant recovery from a commercial vehicle may be greatly facilitated by the use of hydraulic cutting devices to remove pillars, roof panels, doors and seats. In recovery from a commercial vehicle, there may also be many entry and exit points to further facilitate occupant recovery.

[0006] In an armoured vehicle, even after a hazard event, a significant proportion of the hull, cockpit and interior will be structurally intact, and the use of traditional hydraulic cutting tools may be ineffective or may take too long to recover an occupant from an armoured vehicle. The armoured vehicle may further be in a hostile environment and so the time frame of several hours to cut away panels, may not be possible, and may attract unwanted attention to the situation.

[0007] Armoured land vehicles often have limited access portals and doors, as the armoured vehicle is required to withstand severe forces, and so access may be restricted to one major access portal. Further, armoured land vehicles are often cramped and comprise at least one, typically a plurality of protruding features, such as for example, hardware and kit to carry out complex missions. Therefore entering and exiting the vehicle typically comprises manoeuvring via a labyrinthine or tortuous path to avoid the at least one, typically a plurality of protruding features, such as, for example over seats, storage boxes, equipment, further occupants. The protruding features may be rigidly affixed, such as, for example to the walls, roof and/or floor of the vehicle, so cannot be readily removed, during an emergency evacuation.

[0008] Therefore passing a potentially immobilised occupant through an armoured land vehicle interior may cause problems as it will be too restrictive to provide a basic stretcher or trolley/gurney through the vehicle interior, as the rigid frames or poles will not be readily manoeuvrable in confined spaces. Further, attempts to simply pass the occupant through the interior, may cause parts of the occupant or their clothing to snag or entangle with the protruding features. This may cause delay or further injury to the occupant.

[0009] The flexible panel stretcher may be any flexible panel stretcher, which comprises at least one flexible panel. A particularly preferred system is the Sked®. Preferably there are no elongate struts, poles or frames, such as provided by basic fabric stretchers. Preferably the flexible panel stretcher has a continuous exterior surface, such as to mitigate against snagging or impinging on the protruding features in the armoured land vehicle.

[0010] In a preferred arrangement there is at least one pulley removably attached to least one pulley fixing point. The pulley fixing point may be located within the armoured vehicle, exterior to the armoured vehicle, on a support frame, or on the occupant or flexible panel stretcher. Preferably the pulley fixing point is located within the armoured land vehicle, such as for example on a vehicle wall, roof, seat, flexible panel stretcher, and/or occupant to be extracted.

[0011] The pulley may be any pulley system or block that provides mechanical advantage, by use of a line attached thereto. The line may be any rope, cable, chain, webbing strap sufficient to pull the mass of an occupant. The line may be hand drawn or be drawn in by a motorised drum or spool to assist in recovery.

[0012] In a preferred arrangement the occupant comprises at least one pulley fixing point attached to clothing or body armour, removable harness or lanyard, and a pulley removably attached thereto, the pulley comprising a line, such that pulling the line, the occupant is pulled onto a deployed flexible panel stretcher.

[0013] The flexible panel stretcher may comprise at least one restraint to retain the occupant within the flexible panel stretcher. The restraint may be webbing, the webbing may be tightened and locked in place with any common fixing.

[0014] Once the occupant is within the flexible panel stretcher a pulley system may be attached thereto, to avoid further pulling forces being applied directly to the occupant.

[0015] In a preferred method step after the occupant has been secured in the flexible panel stretcher with the at least one restraint, the occupant's seat may be laid flat or the back of the seat may be removed, prior to extraction.

[0016] The flexible panel stretcher comprises at least one pulley fixing point and a pulley removably attached thereto, the pulley comprising a line, comprising the steps

of retracting the line, so as to cause the flexible panel stretcher to manoeuvre the occupant via the labyrinthine path within said armoured land vehicle, to avoid the one or more protruding features. The flexible panel stretcher may be removed from the rear access point of the armoured land vehicle, particularly if the rear of the vehicle allows facile evacuation or allows exit of the occupant into a safer area around the armoured vehicle.

[0017] According to a further aspect of the invention there is provided a recovery system for recovering an occupant from an armoured land vehicle, comprising a flexible panel stretcher, at least one restraint to secure an occupant within the flexible panel stretcher, at least one pulley fixing point provided on said flexible panel stretcher and or occupant, at least one pulley, a line operably linked with said pulley, wherein said system is operated according to the methods defined herein; such that upon pulling the line causes movement of the flexible panel stretcher.

[0018] In a preferred arrangement the flexible panel stretcher may form an integral part of the vehicle, such as for example the flexible panel stretcher may be a detachable part of the seat, such that the flexible panel stretcher is already in position under the occupant, and once in a deployed state may be secured around the occupant with one or more restraints. The flexible panel stretcher may be stowed into a storage box, form part of the wall lining, or floor covering.

[0019] According to a further aspect of the invention there is provided a foldable flexible panel stretcher, comprising a plurality of tiles wherein said tiles are operably linked by articulated joints, such as to provide a foldable flexible panel stretcher.

[0020] The tiles may be manufactured from the same materials as the panels.

[0021] The foldable flexible panel stretcher may comprise only tiles and articulation joints between said tiles, to form the foldable flexible panel stretcher. The foldable flexible panel stretcher may comprise a plurality of flexible layers, said flexible layers comprising a flexible substrate with a plurality of tiles, either attached thereto. Alternatively the tiles may be encapsulated in a cured polymer composite binder, to form FRPC.

[0022] According to a further aspect of the invention there is provided an armoured flexible panel stretcher, comprising at least one armoured flexible panel, wherein said flexible panel comprises at least one fibrous armour material, encapsulated in a polymer binder matrix.

[0023] The fibrous armour material may comprise a Shear Thickening Fluid(STF), the STF may be impregnated into at least one of the fibrous armour material. To prevent the STF from migrating, the fibrous armour material may be encased, such as for example by a textile material, polymer or composite.

[0024] It may be desirable to stow the armoured flexible panel stretcher or allow it to conform to the shape of a wall, roof or floor panel of the vehicle, and so a degree of further flexibility or foldability may be required, in a preferred arrangement, there are at least two armoured panels wherein said armoured panels are secured together by articulated joints, such as to provide a foldable flexible panel stretcher. To prevent the stretcher from impinging on the one or more protruding features the articulated joints may be flush with said armoured panels.

[0025] Preferably the articulated joints are armoured articulated joints.

[0026] The armoured flexible panel stretcher may comprise a plurality of armoured flexible layers, said armoured flexible layers comprising a flexible substrate with a plurality of armoured tiles. The armoured tiles may be manufactured from the same materials as the armoured panels. Alternatively the armoured tiles may be encapsulated in a cured polymer composite binder, to form an armoured FRPC.

[0027] According to a further aspect of the invention there is provided an armoured vehicle, vessel or craft comprising a stretcher as defined herein.

[0028] The armoured stretcher forms when not in use as an evacuation tool, preferably forms an integral part of the armour system of the armoured, vehicle vessel or craft, preferably the armoured stretcher forms part of a spall liner arrangement.

[0029] The panels of the flexible panel stretcher, armoured flexible stretchers, and foldable stretchers with a plurality of panels, preferably comprises at least one layer of, are substantially formed from, or the polymer binder matrix when cured preferably forms a lightweight plastic material, such as medium-density polyethylene or a synthetic thermoplastic resin, selected for durability, strength, flexibility and resistance to damage (such as from cutting, scarring, denting, breaking, and deforming) to provide a suitable stretcher for carrying injured people.

[0030] The fibrous armour material, armoured panels or armoured tiles and/or and the textile material that the encasement is formed from preferably contains aramid fibres, typically poly (paraphenylene terephthalamide) fibres (Kevlar (RTM)). Other high strength fibres which are able to dissipate the kinetic energy of moving objects may be used to form the fibrous armour material. Examples of such fibres include graphite, nylon, glass fibres, nanofibres, and other high strength polymeric fibres such as high strength polyethylene.

[0031] All of the layers of fibrous armour material may be impregnated with the shear thickening fluid. However, it may be advantageous to position the plurality of layers of fibrous armour material impregnated with the shear thickening fluid behind and/or in front of one or more layers of fibrous armour material which are not impregnated with a shear thickening fluid.

[0032] The shear thickening fluid may include particles suspended in a liquid. The particles may be inorganic particles or polymers as is well known in the art. Examples of particles include silica, other oxides, calcium carbonate, and polymers such as polystyrene and poly(methyl methacrylate) and related copolymers.

[0033] The liquid may be an organic solvent, a silicone

based solvent or aqueous liquid. Examples of organic solvents include glycols such as ethylene glycol and polyethylene glycol, and ethanol. Examples of silicone based solvents include silicon oils and phenyltrimethicone.

[0034] Alternatively, the shear thickening fluid may be a polymer. The shear thickening fluid may present in the range of 40 to 60% vol fraction, preferably between 47 and 52% vol fraction.

[0035] The use of the sealed encasement in conjunction with one or more layers of STF-impregnated fibrous armour material is advantageous, because the controlled environment within the encasement can assist in maintaining the useful properties and/or the composition of the STF. For example, the volume fraction of a solvent in the STF can be maintained at or near to a desired value over a period of time. there may be layers of non-armoured materials, such as fabric, coatings, polymers, metals between the STF-impregnated fibrous armour material layers, to allow movement of the STF-impregnated fibrous armour material layers.

[0036] According to a further aspect of the invention there is provided a method of removing an occupant to be extracted from an armoured land vehicle comprising the steps of

deploying an elongate chute from a first stowed position to a second deployed position,

wherein the second deployed position provides a facile transit path such as to avoid one or more protruding features in said armoured land vehicle,

manoeuvring the occupant via the elongate chute, to avoid the one or more protruding features, to a designated access point,

removing the occupant from the access point of the armoured land vehicle.

[0037] The elongate chute may be an elongate flexible panel chute, preferably the elongate chute is an armoured elongate chute.

[0038] The occupant will need to be manoeuvred along the length of the elongate chute, this may be aided by causing a first end of the elongate chute to be elevated with respect to a second end of the elongate chute. In a preferred arrangement the occupant is transferred by means of a pulley system, such is at least one pulley removably attached to least one pulley fixing point. The pulley fixing point may be located with the armoured land vehicle. The pulley fixing point may be located on a vehicle wall, roof, seat, occupant or carrier to be extracted.

[0039] If the occupant needs to be immobilised, preferably there is at least one carrier, said carrier comprising at least one restraint to retain the occupant within said carrier, such that the carrier comprising the occupant may be progressed along the deployed elongate chute.

[0040] The at least one carrier may be a flexible panel stretcher, armoured flexible panel stretcher, foldable flexible panel stretcher; as defined herein before.

[0041] In a preferred arrangement the occupant or carrier comprises at least one pulley fixing point and a pulley removably attached thereto, the pulley comprising a line, such that pulling the line, the occupant or carrier is pulled along the deployed elongate flexible panel chute.

[0042] According to a further aspect of the invention there is provided a recovery system for recovering an occupant from an armoured land vehicle, comprising a deployed elongate chute, at least one pulley fixing point provided on said occupant or an at least one carrier, at least one pulley, a line operably linked with said pulley, wherein said system is operated according to a method defined herein, such that upon pulling the line causes movement of the occupant or the at least one carrier along the deployed elongate chute.

[0043] In a preferred arrangement the elongate chute is an armoured elongate chute, comprising at least one fibrous armour material, encapsulated in a polymer binder matrix.

[0044] The elongate chute may form an integral part of the vehicle, when not in use as an evacuation tool, preferably forms an integral part of the armour system of the armoured, vehicle vessel or craft, preferably the armoured elongate chute forms part of a spall liner arrangement.

[0045] The elongate chute may need to be compacted during stowage, and may preferably comprise at least two panels wherein said panels are secured, panels and or articulated joints may be armoured.

[0046] The panels of the chute, preferably comprises the same materials as for the flexible panel stretcher, foldable flexible panel stretcher or armoured panel stretcher. Preferably at least one layer of, are substantially formed from, or the polymer binder matrix when cured preferably forms a lightweight plastic material, such as medium-density polyethylene or a synthetic thermoplastic resin, selected for durability, strength, flexibility and resistance to damage (such as from cutting, scarring, denting, breaking, and deforming) to provide a suitable stretcher for carrying injured people.

[0047] The fibrous armour material and/or and the textile material that the encasement is formed from preferably contains aramid fibres, typically poly (paraphenylene terephthalamide) fibres (Kevlar (RTM)). Other high strength fibres which are able to dissipate the kinetic energy of moving objects may be used to form the fibrous armour material. Examples of such fibres include graphite, nylon, glass fibres, nanofibres, and other high strength polymeric fibres such as high strength polyethylene.

[0048] All of the layers of fibrous armour material may be impregnated with the shear thickening fluid. However, it may be advantageous to position the plurality of layers of fibrous armour material impregnated with the shear thickening fluid behind and/or in front of one or more layers of fibrous armour material which are not impregnated with a shear thickening fluid.

[0049] The shear thickening fluid may include particles suspended in a liquid. The particles may be inorganic particles or polymers as is well known in the art. Exam-

ples of particles include silica, other oxides, calcium carbonate, and polymers such as polystyrene and poly(methyl methacrylate) and related copolymers.

[0050] The liquid may be an organic solvent, a silicone based solvent or aqueous liquid. Examples of organic solvents include glycols such as ethylene glycol and polyethylene glycol, and ethanol. Examples of silicone based solvents include silicon oils and phenyltrimethicone.

[0051] Alternatively, the shear thickening fluid may be a polymer. The shear thickening fluid may present in the range of 40 to 60% vol fraction, preferably between 47 and 52% vol fraction.

[0052] The use of the sealed encasement in conjunction with one or more layers of STF-impregnated fibrous armour material is advantageous, because the controlled environment within the encasement can assist in maintaining the useful properties and/or the composition of the STF. For example, the volume fraction of a solvent in the STF can be maintained at or near to a desired value over a period of time.

[0053] An embodiment of the invention will now be described by way of example only and with reference to the accompanying drawings of which:-

Figure 1 shows a cross section of an armoured panel
Figure 2 shows a cross section of an encased armoured panel
Figure 3 shows an occupant in a flexible panel stretcher in an armoured vehicle
Figure 4 shows an armoured flexible panel stretcher
Figure 5 shows a foldable flexible panel stretcher in an armoured vehicle with pulley system
Figure 6 shows a labyrinthine path through an armoured vehicle.
Figure 7 shows a deployed elongate chute in an armoured vehicle
Figure 8 shows an articulated and foldable flexible panel stretcher
Figures 9a and 9b show a layered arrangement of tiles to form a foldable flexible panel.

[0054] Turning to Figure 1, there is provided Figure 1 depicts an arrangement of a portion of an armoured panel of the invention, shown generally at 10, comprising a plurality of fabric layers 12, formed from fibres of an armour material such as Kevlar (RTM), which are encased within a sealed encasement 14. In the embodiment shown in Figure 1, the encasement 14 is formed from a textile armour material 14a such as Kevlar (RTM) laminated with layers 14b of an ionomer such as Surlyn (RTM). The encasement 14 is sealed along seal lines 14c formed in the layers 14b of the ionomer. Conveniently, this can be achieved by heat sealing.

[0055] Figure 2 shows a sheet 20 which can be used as a precursor of the encasement 14. The sheet 20 comprises a layer of a textile armour material 22 which is laminated on its front and back faces with a first layer 24 and a second layer 26, respectively, of an ionomer. Lamination can be accomplished readily by the application of heat and pressure. Advantageously, the dimensions of the first and second layers 24, 26 of the ionomer are greater than those of the layer of a textile armour material 22 so that there is a perimeter region 28 of ionomer which surrounds the edges of the layer of a textile armour material 22. The arrangement of protective material can be produced by providing two sheets 20, placing the plurality of fabric layers between the two sheets 20 and heat sealing along the perimeter regions 28 of the sheets 20.

[0056] Turning to Figure 3 there is provided a flexible panel stretcher 31 located in a cabin 30 of an armoured vehicle. The stretcher further comprises a plurality of restraints 32, particularly in the form of webbing to secure the occupant 34, therein. The flexible panel stretcher The interior has a plurality of protruding features 33, such as a bench 33a, wall mounted equipment 33b, and seat 33c.

[0057] Turning to figure 4 there is provided an armoured flexible panel stretcher 41, comprising an armoured panel 48, and optionally an outer non-armoured layer 49. The armoured panel 48 comprises at least one fibrous armour material 47 which is encapsulated in a polymer binder matrix 46. The polymer binder matrix may be selected from any polymer and may be the same polymer as the outer non-armoured layer 49. The polymer binder matrix may comprise further filler materials 45 to improved wear and tear, or prevent chemical degradation. The at least one fibrous armour material may comprise an STF, as shown in Fig 1 and 2 above. The armoured flexible panel stretcher 41 may when not in use as an evacuation tool be used as part of an armour system for a vehicle, such as an applique system or further as a spall liner.

[0058] Turning to figure 5, there is provided an interior cabin 40 of an armoured vehicle (vehicle exterior not shown). The cabin has a plurality of protruding features 43, such as shelving 46, seat 43c. The occupant 44 has been secured into the flexible panel stretcher 41. As it may be difficult to get extra personnel in to manoeuvre the flexible panel stretcher 41, a pulley 47, attached to a pulley fixing point 49, is located in the cabin. The pulley 47 is comprises a line 48, which is this case is attached to a further pulley 47a, the pulley 47 is attached to the occupant 44 via a harness (not shown), or the pulley 47a may be attached to a pulley fixing point (not shown)on the stretcher 41. As the line 48 is pulled it causes the occupant 44 in the stretcher 41 to be manoeuvred through the tortuous or labyrinthine path past the protruding features 43.

[0059] Turning to figure 6, there is provided a schematic of the interior of the cabin 50 of an armoured vehicle with a plurality of protruding features 56, and the seat 53. The path 55a-c that the stretcher 51 is to be manoeuvred through is tortuous or labyrinthine, as the stretcher needs to be negotiated past the protruding features 56. The occupant 54 may be wrapped in the stretcher 51, and may further comprise a series of restraints, belts or im-

mobilising neck braces(not shown) in order to securely and safely transfer the occupant, until the stretcher 51 reaches the exit 57 of the vehicle where a more conventional trolley or gurney may be used.

[0060] Turning to figure 7 there is provided a schematic of the interior of the cabin 60 of an armoured vehicle with a plurality of protruding features 66, and the seat 63. The path that the occupant is to be manoeuvred through is tortuous or labyrinthine. The use of an elongate chute 62, may be deployed along substantially the entire length of the interior cabin 60, which provides a smoothed out path to allow ready negotiation past the protruding features 66 and seat 63. The occupant 64b may comprise a pulley fixing point 65b, said fixing point may be attached to a harness or clothing, and the occupant may be directly manoeuvred along the elongate chute 62 by action of a pulley system (not shown) to an exit 67 of the vehicle. The occupant 64a may first be wrapped in the flexible panel stretcher 61, and may further comprise a series of restraints, belts or immobilising neck braces(not shown) in order to securely and safely transfer the occupant. The flexible panel stretcher 61 may comprise a pulley fixing point 65a, attached thereto, and the occupant 64a in the stretcher 61 may be manoeuvred along the elongate chute 62 by action of a pulley system (not shown) to an exit 67 of the vehicle until the flexible panel stretcher 61 reaches the exit 67 of the vehicle where a more conventional trolley or gurney may be used.

[0061] Turning to Figure 8 there is provided an articulated flexible panel stretcher 71, which can support an occupant 74. The stretcher 71 comprises a plurality of panels 72 which are fastened with articulated joints 73 to provide a stretcher. The panels 72 and articulated joints 73 may be armoured or non-armoured. The joints 73 may be fibrous material, fibrous armour material and/or may be cured in an elastomeric binder.

[0062] Turning to fig 9a there is provided a first flexible layer 80a comprising a flexible substrate 81 a, with a plurality of tiles 82a attached thereto. The tiles 82a may alternatively be embedded or encapsulated between two or more substrates 81a (not shown). The tiles may have a longest dimension of w, and may be spaced apart from each other by a gap 85, which acts as a joint to articulate the adjacent tiles. The gap 85 may have a distance x and y, preferably x and y are the same distance. Preferably the distance x and y are selected such that they are in the range of 10% to 50% of the distance of the longest dimension w of the tile, more preferably 20% to 35%, most preferably x and y are 1/n of the distance of w, where n is the number of discrete flexible layer as shown in figure 9b, such that for 3 discreet layer the gap is 1/3 of w.

[0063] The flexible layers 80a may be formed from tiles 82a bonded between sheets of aramid felt/elastomer or aramid cloth which form the flexible substrates.81 a, by techniques, such as for example adhesives or thermal weld. The tiles 82, may be ceramic, metal, polymers, composites, such as for example Aramid/thermoplastic composite, HDPE/UHMWPE composite. The tiles are preferably rigid, relative to the flexible substrates.

[0064] The tiles 82a may be any dimension, but preferably less than 100mm, more preferably in the range of 5 to 50mm, yet more preferably 10mm to 20mm to give good flexibility/minimum radius

[0065] Figure 9b shows a flexible panel structure 83, such as would form the flexible panel stretcher or flexible elongate chute, which comprises first, second and third flexible layers 80a, 80b and 80c, respectively, (the flexible substrates upon which the tiles are arranged, are not shown, so that the arrangement of the three flexible layers and more specifically the tiles, can be seen) The flexible layers 80a, 80b and 80c are offset from each other, with relation to the tiles, preferably by a fixed distance S and distance T. Preferably, distances S and T are the same between each pair of discrete flexible panels 80a/80b or 80b/80c up to $80_n/80_{n+1}$. Preferably the distances S and T are selected such that they are in the range of 10% to 50% of the distance of the longest dimension w of the tile, more preferably 20% to 35%, most preferably S and T are 1/n of the distance of w, where n is the number of discrete flexible layers, such that for 3 discreet layer the gap is 1/3 of w. Preferably the distances S and T are selected to be substantially equivalent to distances x and y.

[0066] The three flexible layers 80a, 80b and 80c preferably have identical spacing and construction, and the arrangement shown provides a structure with substantially no gaps. The flexible layers are free to move across each other for drape/conformal. The flexible substrate 81 a may permit some stretch to allow material to bend especially if tiles can move sideways so that gaps line up. Specific areas of rigidity could be made by stitching/bonding layers together locally to stop them moving laterally relative to each other.

[0067] In a preferred arrangement to provide an enhanced armour effect, the use of STF material 84 may be filled between flexible layers to create rigid layer when under high strains, preferably where STFs are used a further outer layers may encapsulate to retain the STF within the flexible panel.

Claims

1. An armoured flexible panel stretcher, comprising at least one armoured flexible panel, wherein said flexible panel comprises at least one fibrous armour material, encapsulated in a polymer binder matrix.

2. A stretcher according to claim 1, wherein the fibrous armour material comprises a shear thickening fluid.

3. A stretcher according to claim 1 or claim 2, wherein the fibrous armour material is encased by non-fibrous armour materials.

4. A stretcher according to any one of the preceding claims comprising at least two armoured tiles wherein said armoured tiles are secured together by articulated joints, such as to provide a foldable armoured flexible panel stretcher.

5. A stretcher according to claim 4, wherein there is a plurality of flexible layers, said flexible layers comprising a flexible substrate with a plurality of armoured tiles.

6. A stretcher according to claim 4, wherein the articulated joints are flush with said armoured tiles.

7. A stretcher according to claim 4 or 5 wherein the articulated joints are armoured joints.

8. A stretcher according to any one of the preceding claims, wherein the shear thickening fluid is present in the range of 40 to 60%.

9. A stretcher according to any one of the preceding claims wherein the fibrous armour material is Kevlar.

10. A method of removing an occupant from an armoured land vehicle comprising the steps of
deploying an armoured flexible panel stretcher, as defined in any open of the preceding claims, locating the occupant in the armoured flexible panel stretcher,
retaining the occupant within said armoured flexible panel stretcher, manoeuvring the occupant via a labyrinthine path within said armoured land vehicle, to avoid one or more protruding features,
removing the occupant from an access point of the armoured land vehicle.

11. A recovery system for recovering an occupant from an armoured land vehicle, comprising an armoured flexible panel stretcher, as defined in any one of the preceding claims, at least one restraint to secure the occupant within the armoured flexible panel stretcher, at least one pulley fixing point provided on said armoured flexible panel stretcher and or occupant, at least one pulley, a line operably linked with said pulley, wherein said system is operated according to a method according to claim 9, such that upon pulling in the line causes movement of the flexible panel stretcher.

12. An armoured, vehicle, vessel or craft comprising a stretcher according to any one of claims 1 to 8.

13. An armoured, vehicle, vessel or craft according to claim 11, wherein the armoured stretcher forms an integral part of the armour system of the armoured, vehicle, vessel or craft.

14. An armoured, vehicle, vessel or craft according to claim 12, wherein the armour system is a spall liner.

Fig. 1(a)

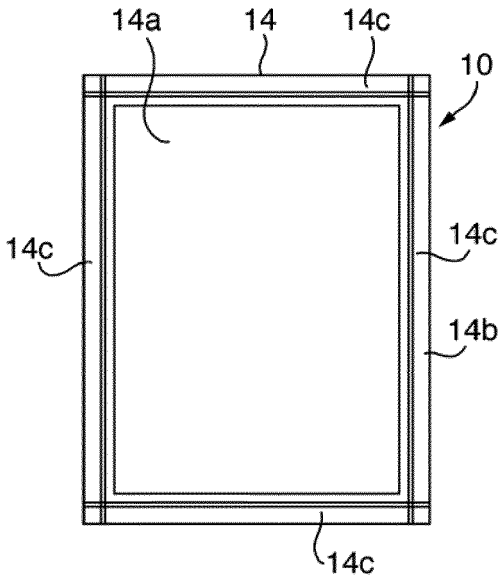


Fig. 1(b)

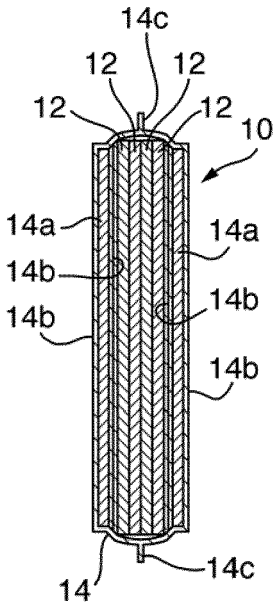


Fig. 2(a)

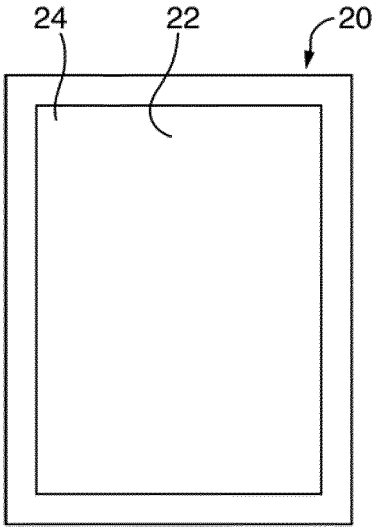
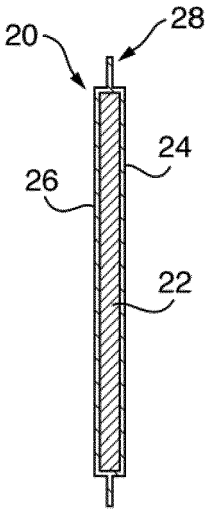


Fig. 2(b)



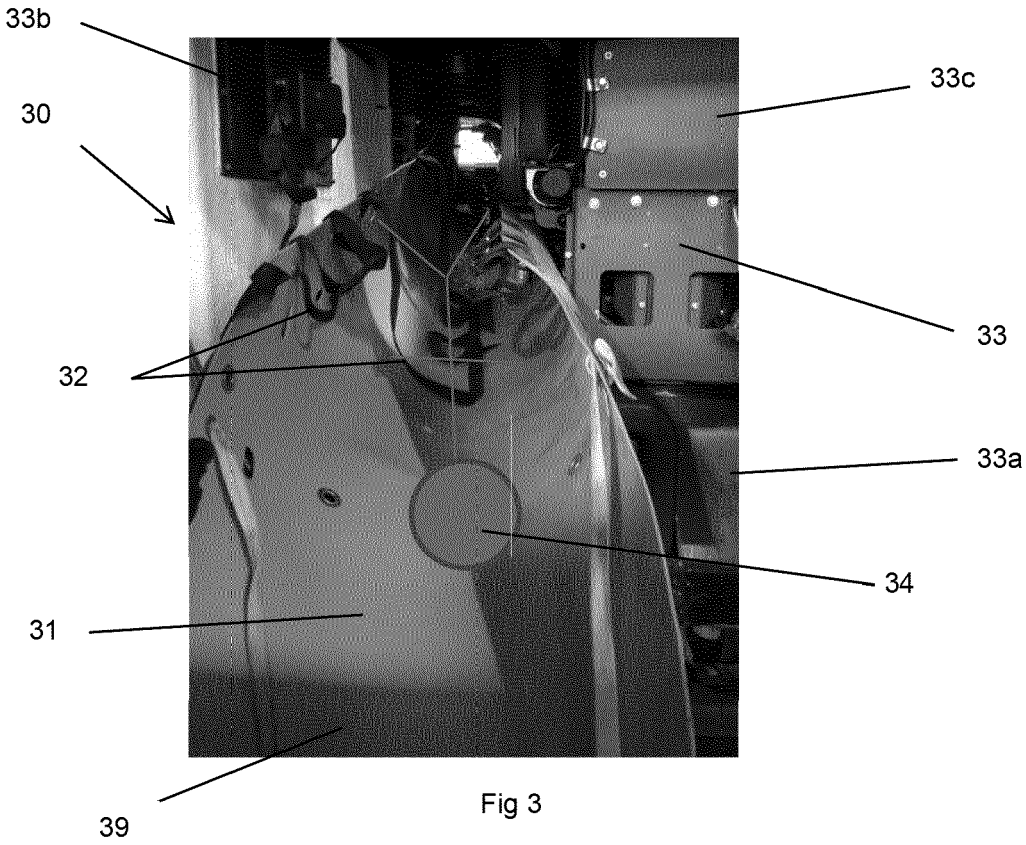


Fig 3

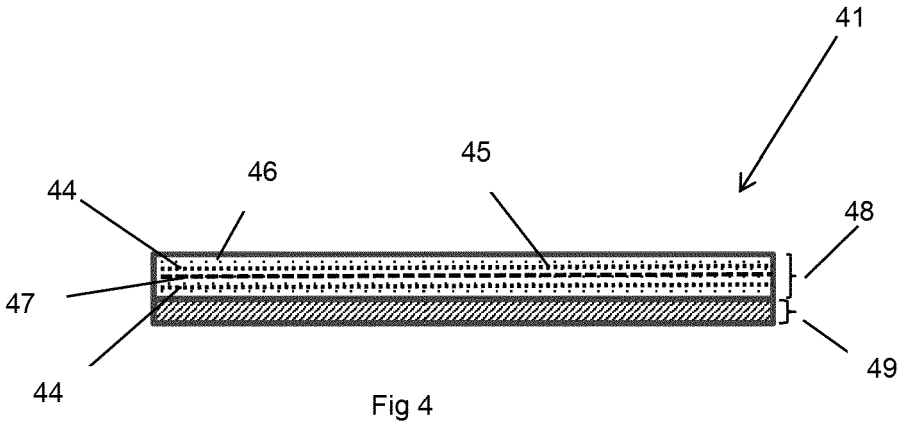


Fig 4

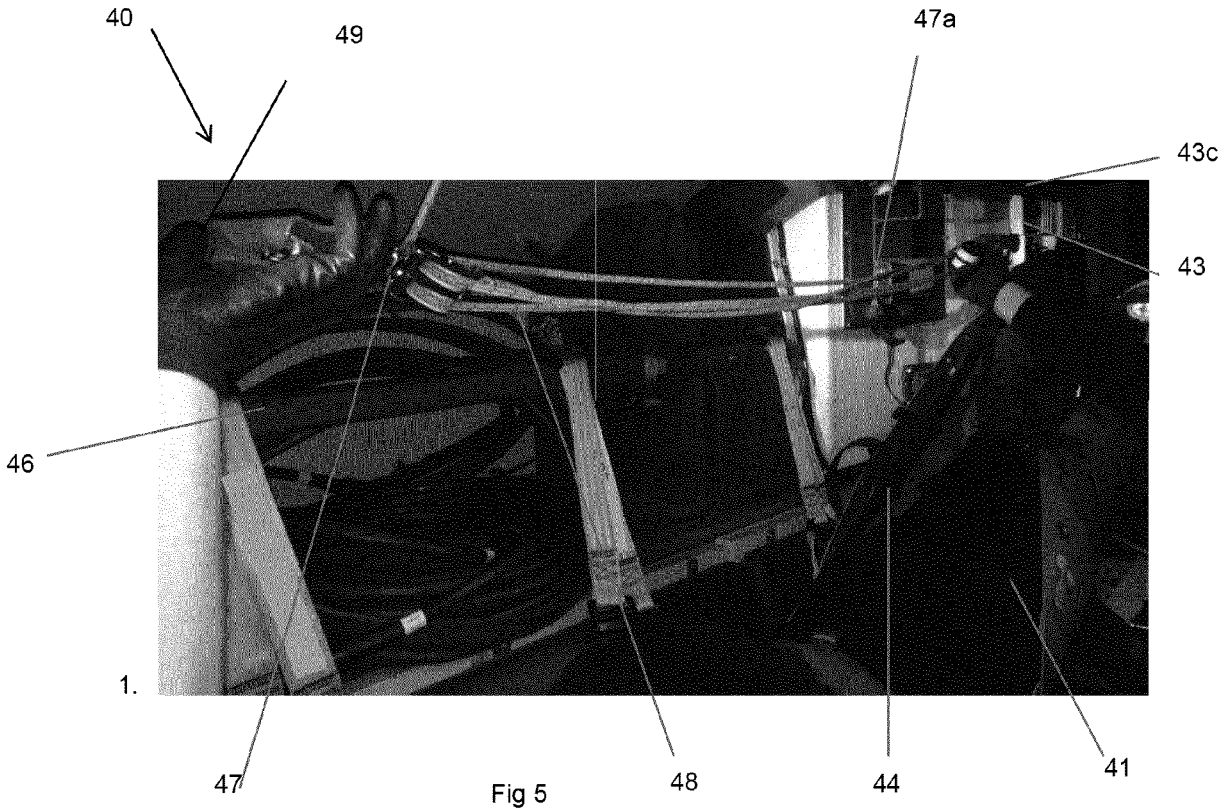


Fig 5

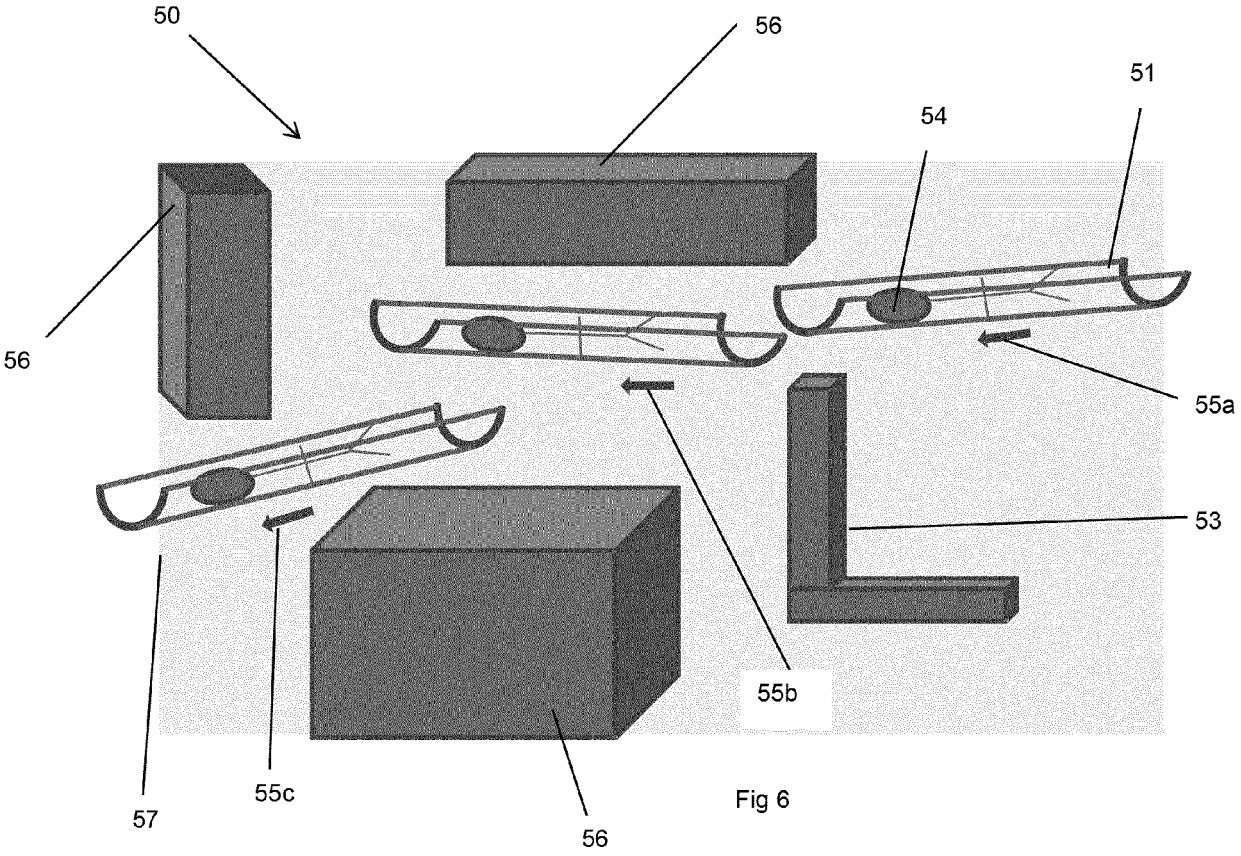

50
56
51
54
56
55a
53
55b
57
55c
56

Fig 6

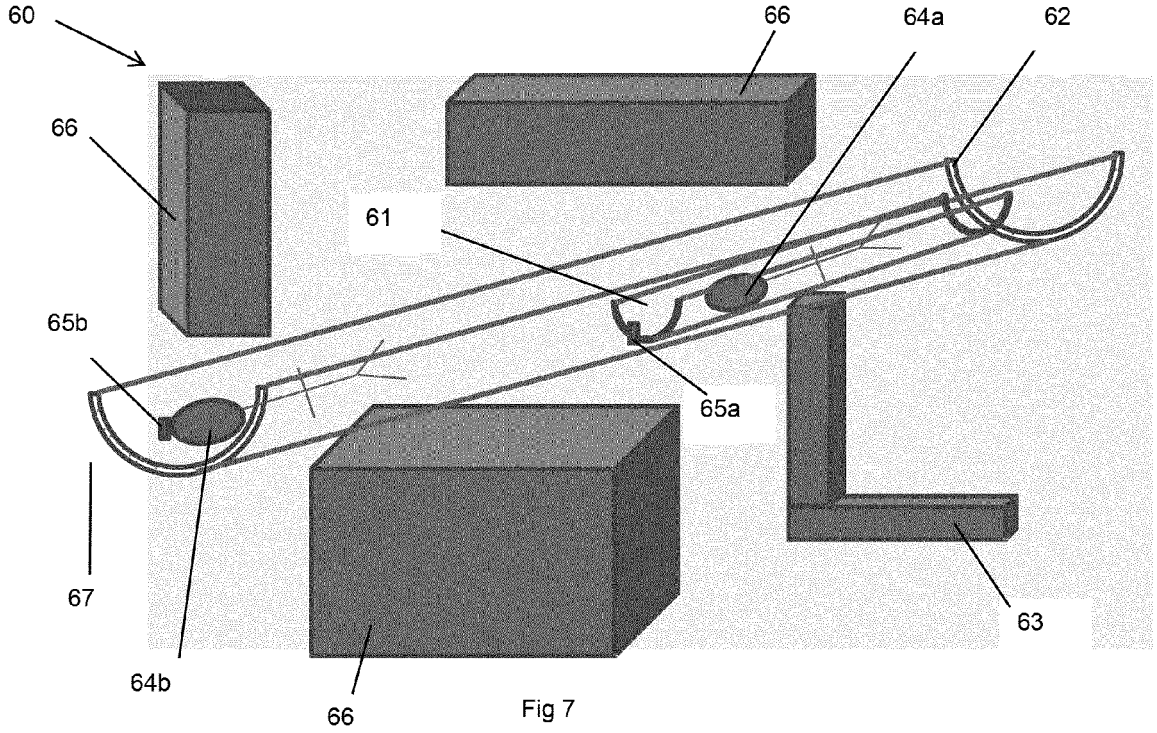

60
66
64a
62
66
61
65b
65a
67
63
64b
66

Fig 7

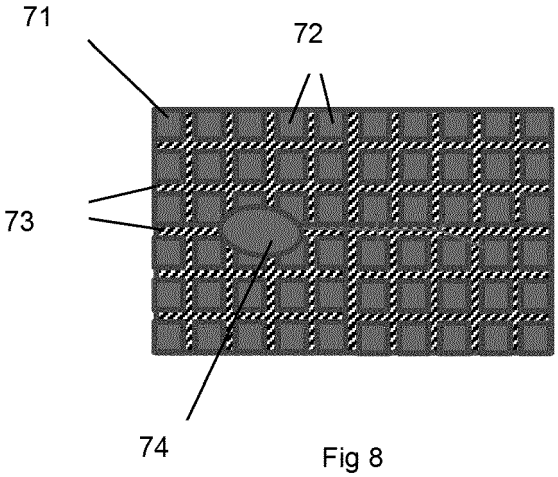


Fig 8

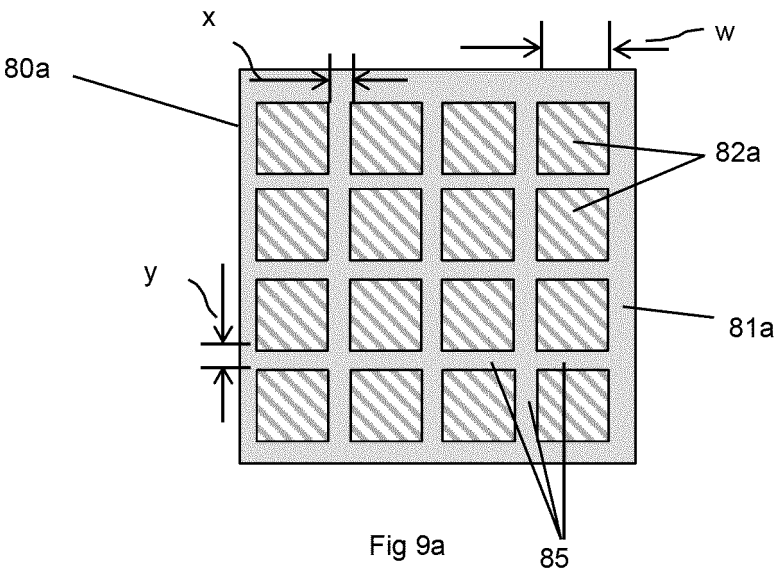


Fig 9a

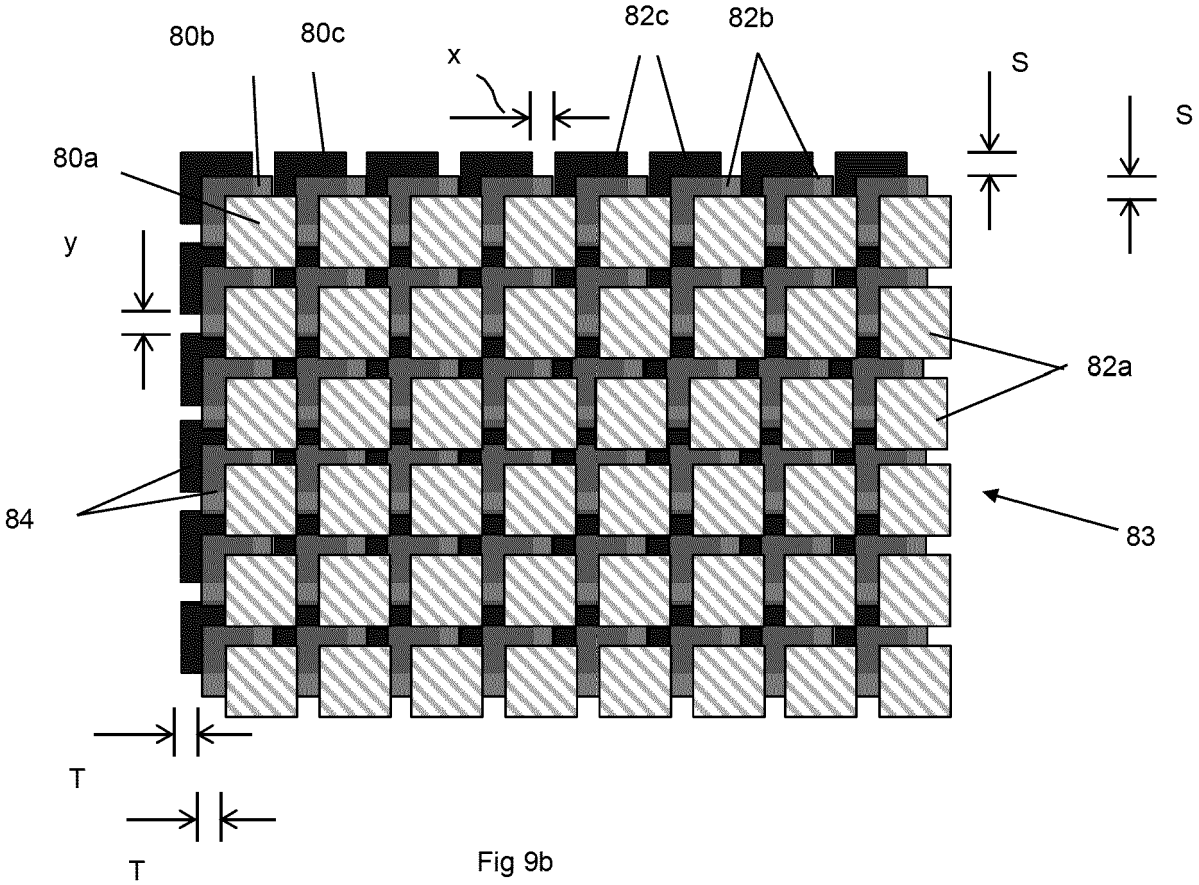


Fig 9b

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 27 5060

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 Y	US 2015/283007 A1 (CARLSON KENNETH JOHN [US]) 8 October 2015 (2015-10-08) * paragraphs [0005], [0019], [0024], [0029], [0030]; figures 1-7 *	1-10 11-14	INV. A61G1/04 A61G1/044 A61G1/013
X	US 5 720 303 A (RICHARDSON PATRICK J [US]) 24 February 1998 (1998-02-24) * column 4, lines 1-22; figures 1-5 *	1,3-7,9, 10	
X	WO 02/39010 A2 (MALLINCKRODT INC [US]) 16 May 2002 (2002-05-16) * page 8, paragraphs 2,3; figures 1-8 *	1,3	
Y A	US 2012/060277 A1 (RADZINSKY YEVGENIY [US]) 15 March 2012 (2012-03-15) * figures 8-17 *	11-14 10	
A	GB 2 496 678 A (BAE SYSTEMS PLC [GB]) 22 May 2013 (2013-05-22) * page 3, lines 14-16 *	1-3	
			TECHNICAL FIELDS SEARCHED (IPC) A61G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 October 2016	Gkama, Alexandra

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 27 5060

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-10-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015283007 A1	08-10-2015	NONE	
US 5720303 A	24-02-1998	NONE	
WO 0239010 A2	16-05-2002	US 6527075 B1	04-03-2003
		WO 0239010 A2	16-05-2002
US 2012060277 A1	15-03-2012	US 2012060277 A1	15-03-2012
		WO 2012036726 A1	22-03-2012
GB 2496678 A	22-05-2013	AU 2012338635 A1	05-06-2014
		EP 2780658 A1	24-09-2014
		GB 2496678 A	22-05-2013
		US 2014311329 A1	23-10-2014
		WO 2013072667 A1	23-05-2013

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82