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(54) **ARMOURED VEHICLE**

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(57) **ABSTRACT**

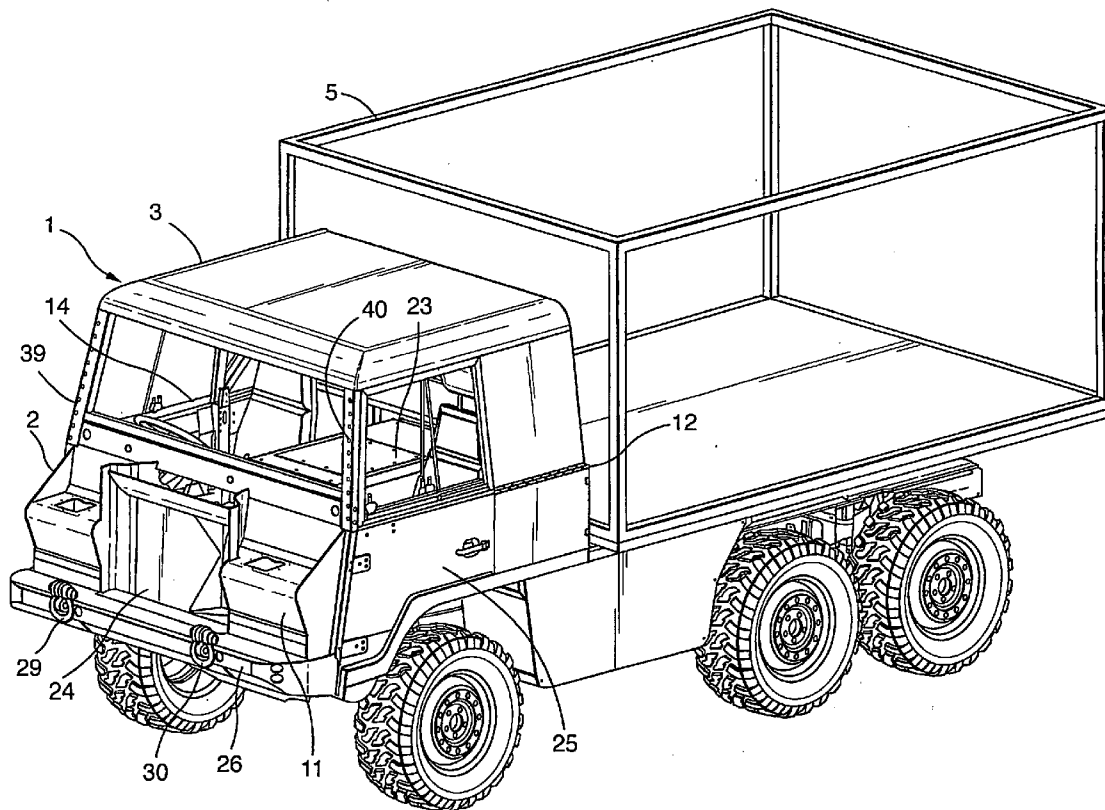
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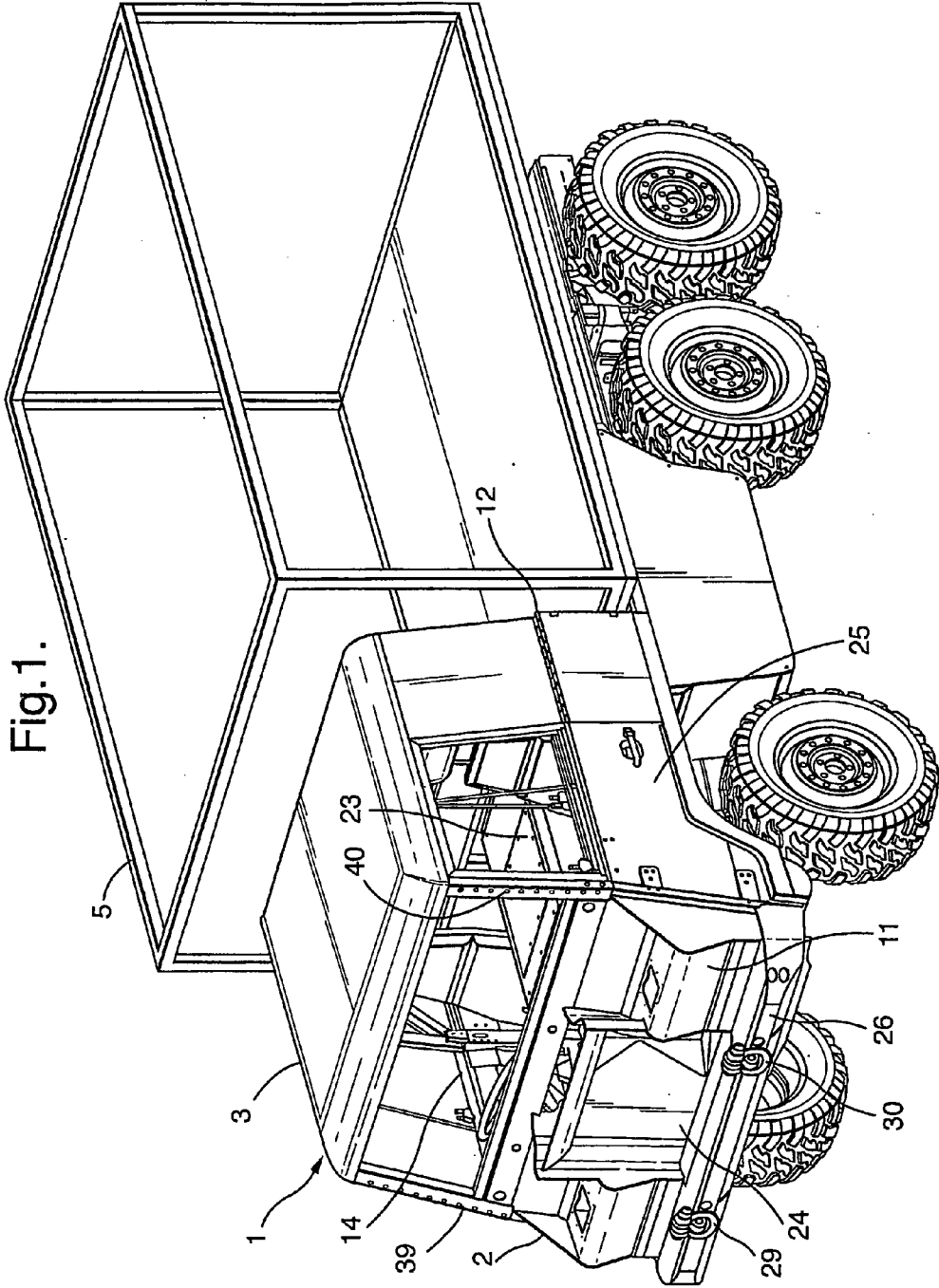
An armoured vehicle is provided having an armoured driver's cab (2, 3) including seating and controls for at least engine, steering, brakes and gears of the vehicle. The drivers cab includes permanent armour (2) and a removable optionally armoured element in the form of an upper cab (3). The upper cab may be removed without disturbing the seating and controls.

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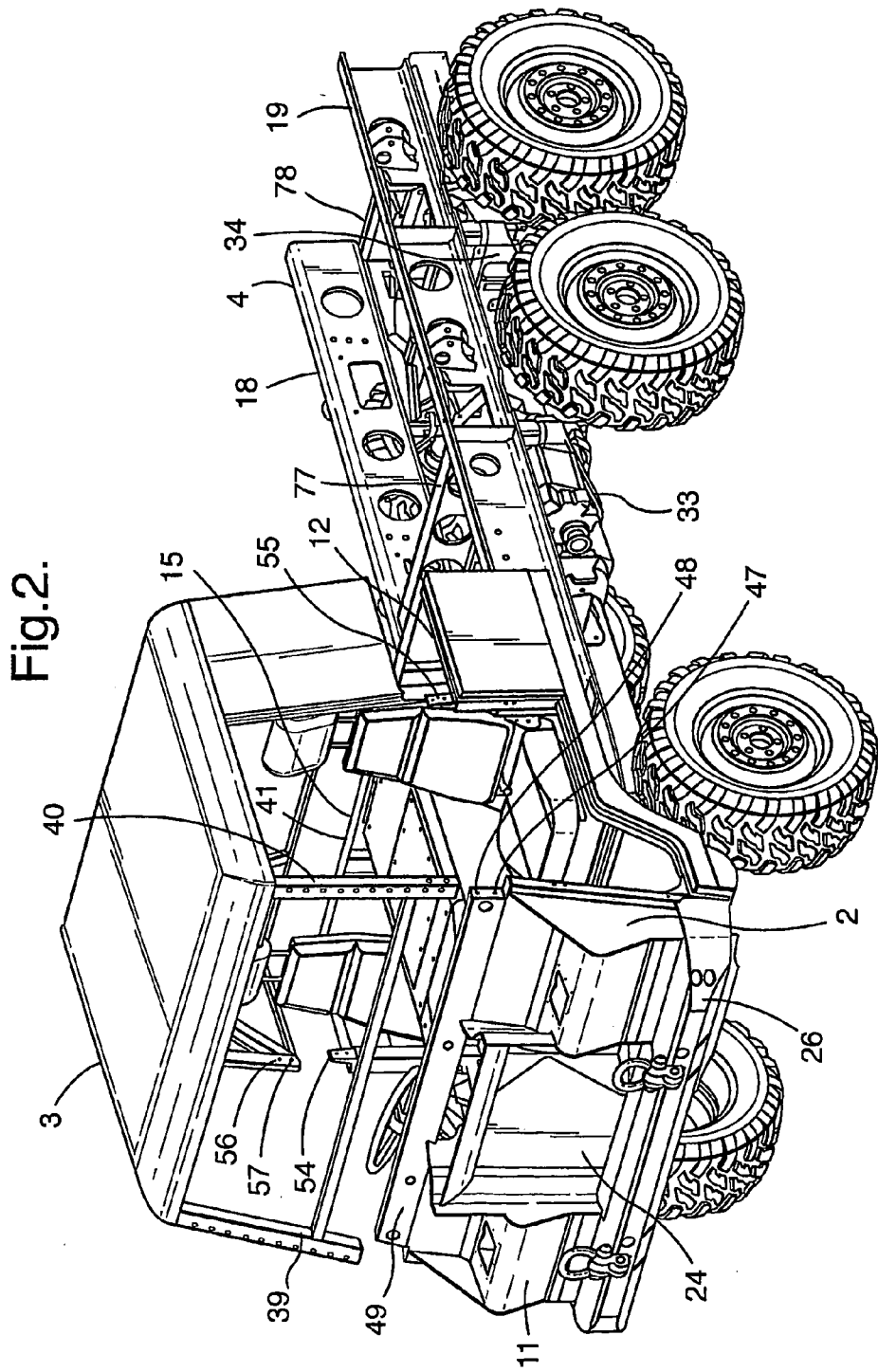
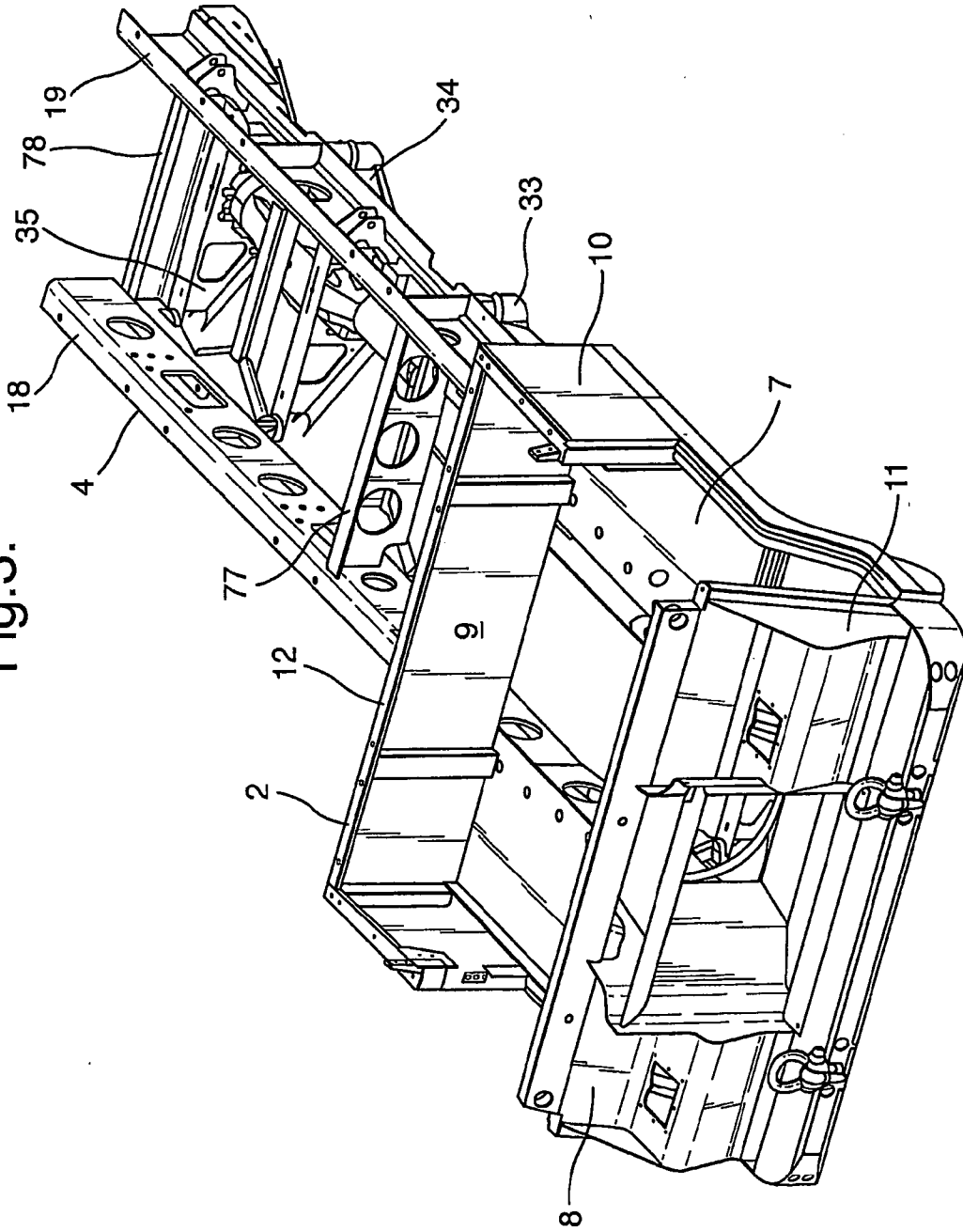


Fig.3.



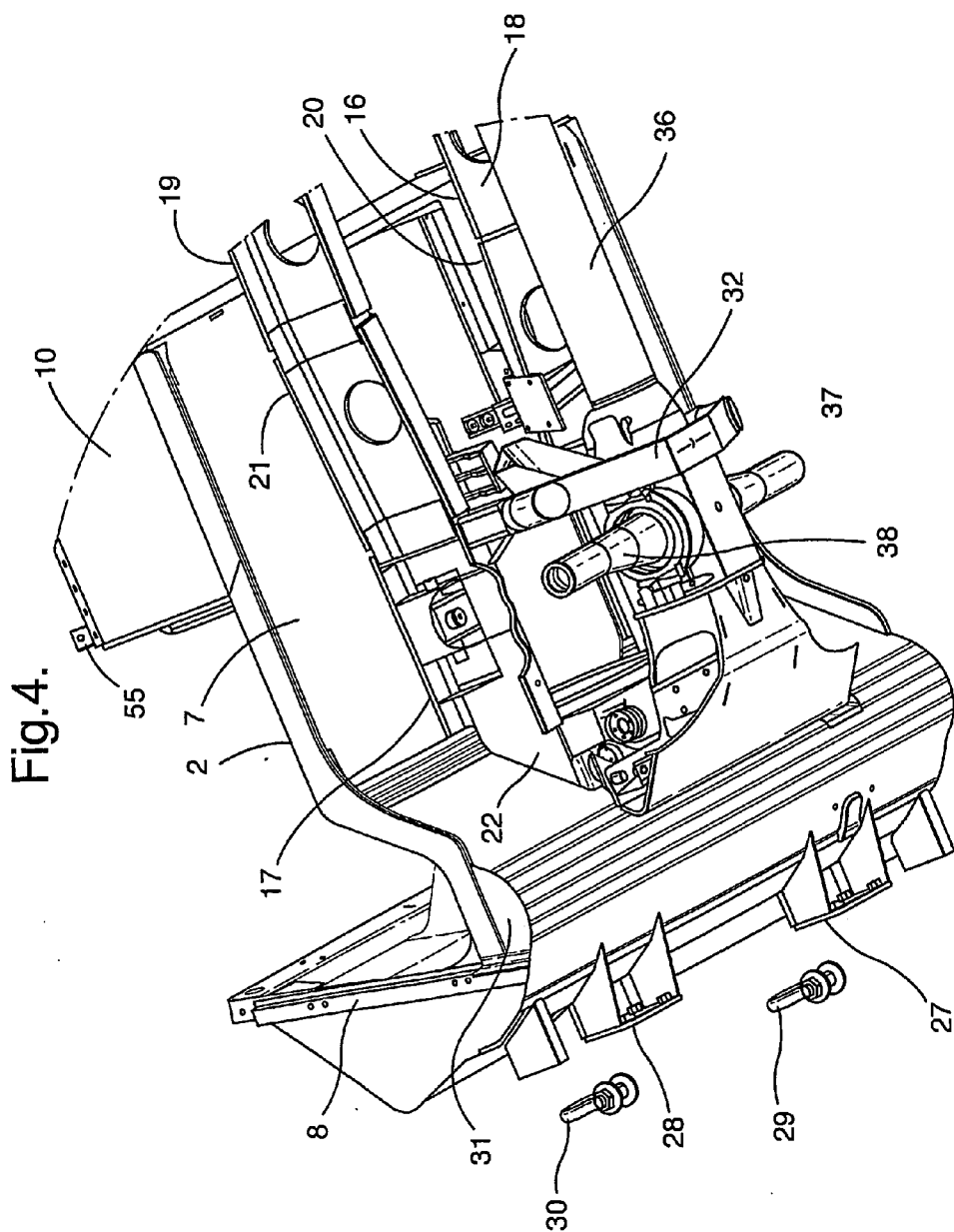
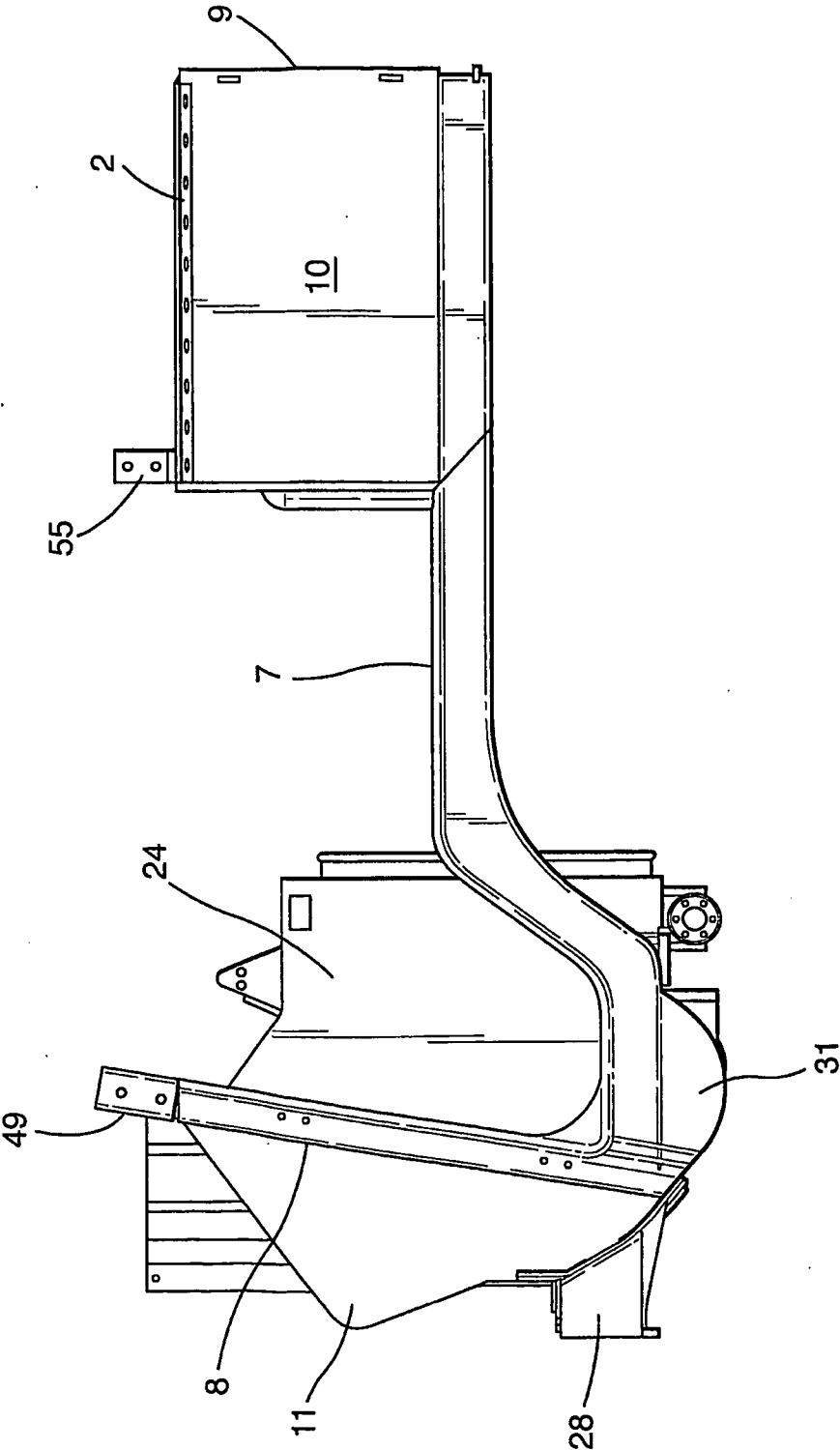


Fig. 5.



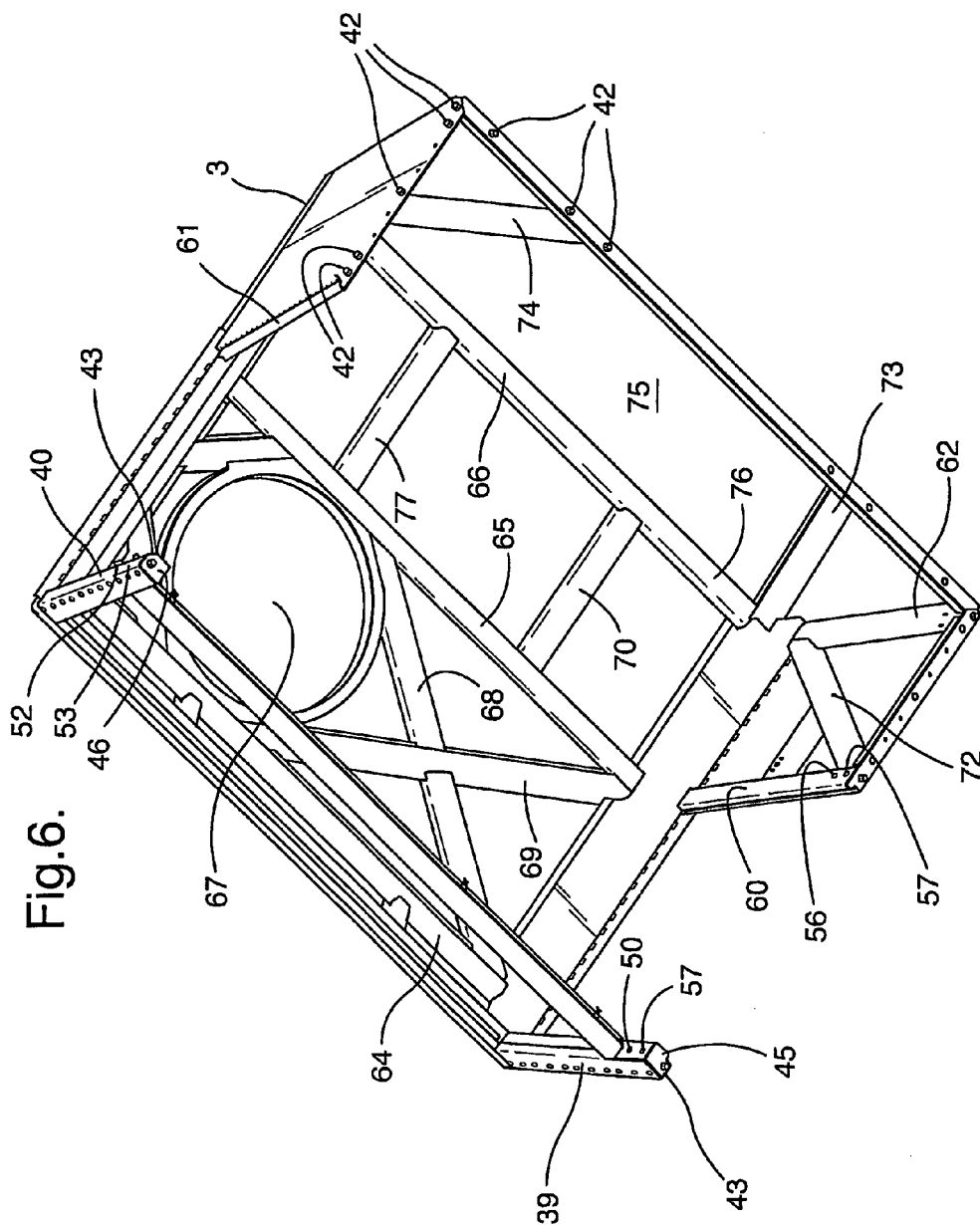
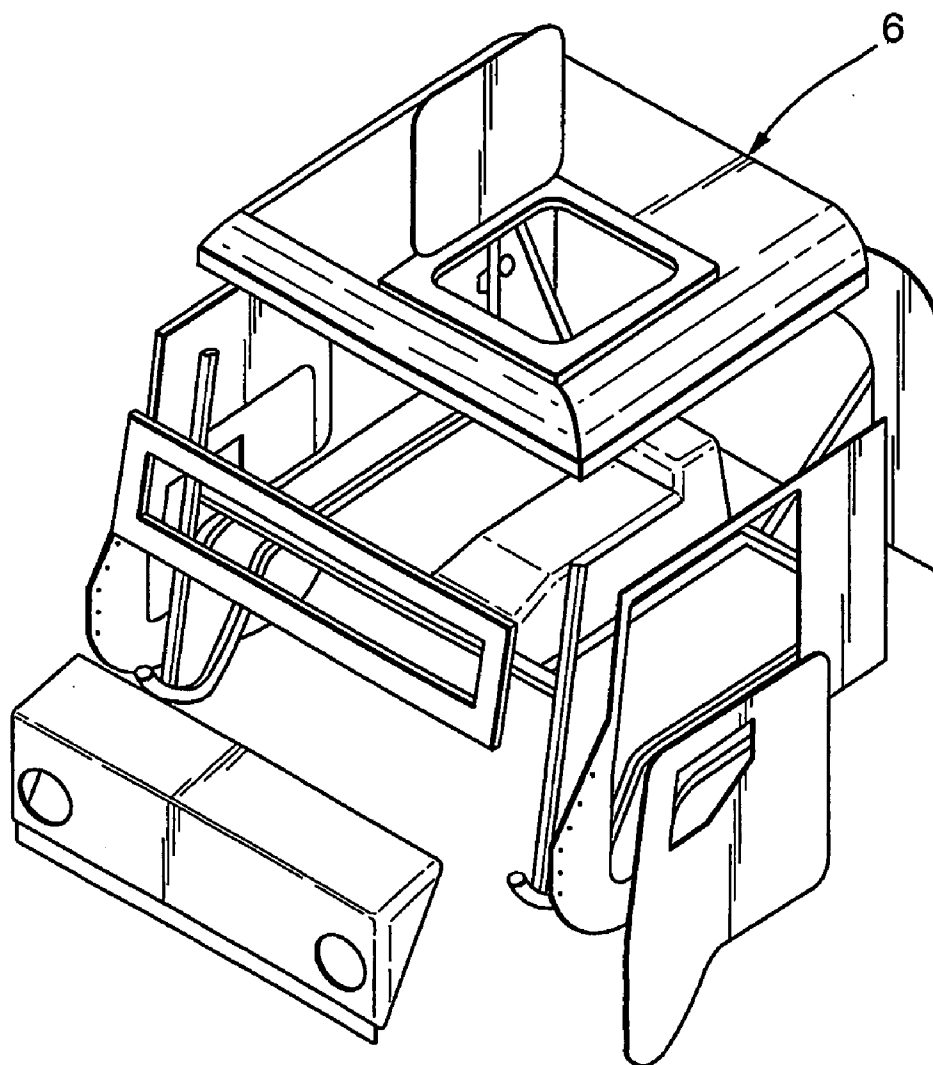


Fig.7.



ARMoured VEHICLE

[0001] This invention relates to armoured vehicles and in particular to armoured vehicles with bodywork adaptable for differing uses.

[0002] Armoured vehicles are normally used for military or policing duties where occupants of the vehicle are liable to attack from rival forces or demonstrators or the like. Vehicle armour varies in thickness and composition according to the perceived level of threat. Steel plate of varying thickness, hardness and other metallic properties is most commonly used. Additionally, carbon fibre composites are known to be used, usually in addition to the metal plate, to prevent the vehicle occupants from injury from certain types of impact on the armour. It will be appreciated that armour, at least when it is in the form of metal plate, can add very considerably to the weight of the vehicle. This can adversely affect vehicle performance. For example, vehicle payload will be reduced; performance and manoeuvrability will be adversely affected and fuel consumption will be increased. A further commonly acknowledged difficulty with armoured vehicles is the severely reduced window area. Owing to the vulnerability of glass to attack by weapons, glass area is usually reduced in armoured vehicles and visibility out of the vehicle from within for driver and passengers is therefore severely restricted. This is likely to affect both the speed at which the vehicle can safely travel and can even affect the type of route which the vehicle may safely navigate. The reduced window area is also likely to lead to greater occurrence of accidents to the vehicle with consequent time out of service and increased repair costs.

[0003] It is therefore an object of the invention to provide an armoured vehicle wherein at least part of the armour is removable in a practical and relatively speedy manner when not required.

[0004] According to the invention there is provided an armoured vehicle having an armoured driver's cab including seating and controls for at least engine, steering, brakes and gears of the vehicle, the driver's cab including permanent armour and a removable optionally armoured element and wherein the removable element may be removed without disturbing the seating and controls.

[0005] The removable optionally armoured element of the cab may be fully armoured to complement the permanent armour of the cab or it may be unarmoured for use when there is insufficient threat to the occupants of the vehicle to warrant armoured protection.

[0006] Because the removable element can be removed without disturbing the seating and controls, the removable element may be removed and replaced with an element of different design, if required, in a relatively straightforward manner. If the removable element of the cab comprises an upper element thereof, this upper element may be changed by simply removing it from the permanent armour by lifting it off the permanent armour and dropping a replacement removable element into position. In this way a vehicle, according to the invention, may be converted from a fully armoured condition to a relatively unarmoured condition in, say, a matter of, at most, a few hours. This will then allow use at higher speed, over more rugged terrain and possibly over greater distances without refuelling, with the additional option of a greater payload being carried.

[0007] It can thus be envisaged, for example, that a vehicle according to the invention may be used in its relatively unarmoured condition for transporting materials or personnel to the battlefield region. Once these duties are accomplished it may be subjected to a rapid conversion, conveniently overnight, into a fully armoured condition ready for use at the battlefield the following day.

[0008] For policing roles in unstable political conditions, the vehicle of the invention may be used with a non-armoured removable cab element for quieter periods and rapidly converted to a fully armoured condition should hostilities break out. It will be appreciated that to provide non-armoured and fully armoured alternative vehicles for differing political conditions would be prohibitively expensive. The vehicle of the invention allows a single vehicle to be used for widely differing conditions with minimal additional cost by providing differing removable elements for the cab.

[0009] Preferably, the permanent armour includes at least a floor of the cab and may include a forward bulkhead and optionally rear and/or side walls of the cab. The forward bulkhead can conveniently comprise external bodywork of the vehicle. In this way, the removable element of the cab may be an upper element thereof and may be simply dropped into position on the permanent armour.

[0010] The permanent armour may form a structural part of the chassis of the vehicle and, to this end, may be structurally attached to two longitudinally extending chassis rails of the vehicle. To provide further structural rigidity, the chassis rails may be structurally attached to a longitudinally extending transmission tunnel adapted to provide longitudinal torsional stiffness to the chassis. This arrangement, in combination with the attached permanent armour, provides a structurally efficient structure for a chassis for the vehicle. One particular design provides for the welding of the two chassis rails directly to the permanent armour at forward ends of the chassis rails.

[0011] The removable element may be armoured, non-armoured or partially armoured.

[0012] In one embodiment, the removable element is joined to the permanent armour in a generally horizontal plane level with a base of windows for the cab. In this embodiment windscreen pillars may be included in the removable element to enable a unitary upper cab structure which includes a windscreen and which may be appropriately reinforced to withstand rollover impact loads.

[0013] To this end, the removable element may include pairs of A, B or C pillars disposed at either side of the vehicle wherein each pair of pillars is structurally connected together at an upper end thereof by a structural member in a roof of the cab. Thus, effectively, three "rollover hoops" within the structure of the removable element of the cab are provided. Further cross bracing as necessary between the rollover hoops may be provided to assist the cab in withstanding rearwardly directed, forwardly directed or sideways directed loads, or any combination thereof.

[0014] The A and B pillars may have reinforced connections to the permanent armour whereby to resist vehicle rollover impacts. Modelling has shown that the bases of the A and B pillars may have to absorb particularly large loads when certain rollover impact forces are applied to the removable element of the cab.

[0015] The invention will now be described by way of example with regard to the accompanying drawings of which:—

[0016] FIG. 1 is a forward perspective view of an armoured vehicle according to the invention with load container attached;

[0017] FIG. 2 shows the vehicle of FIG. 1 without the load container and with a removable element raised from permanent armour of the vehicle;

[0018] FIG. 3 is a forward perspective view of an armoured vehicle chassis including permanent armour;

[0019] FIG. 4 is an underneath perspective view of a forward portion of the vehicle chassis of FIG. 3;

[0020] FIG. 5 is a side elevation of permanent armour of a vehicle according to the invention;

[0021] FIG. 6 is an upward perspective view of a removable element in the form of a non armoured cab top for use on the vehicle of the invention, and

[0022] FIG. 7 is an upper perspective exploded view of an armoured cab adaptable for a vehicle according to the invention.

[0023] Referring to FIGS. 1 and 2 of the drawings, an armoured vehicle according to the invention is shown having a driver's cab 1 comprising permanent armour 2 and a removable element in the form of an upper cab 3. The vehicle is a six wheeled all wheel drive cross country vehicle designed primarily for military and police usage. A similar vehicle with four wheels only may be used with substantially the same chassis and transmission tunnel, shortened appropriately. The vehicle is designed to be extremely versatile, having a two-railed chassis 4 adapted to support load carrying modules 5 of differing design. The version shown in FIG. 1 is of a shape suitable for carrying animals such as police or military dogs. Variants for transporting personnel such as troops and equipment and weapons are available. The load carrying module 5 is designed to be rapidly removed from the chassis for rapid conversion of the vehicle to alternative usage.

[0024] The driver's cab 1 is shown assembled in FIG. 1 and with the upper cab raised in FIG. 2. The permanent armour is shown in detail in FIGS. 3, 4 and 5. The upper cab 3 is shown in detail in FIG. 6. A fully armoured version 6 of a cab is illustrated in FIG. 7, in exploded form. Referring particularly to FIGS. 3, 4 and 5, the permanent armour, in the form of a lower cab portion 2, is shown as having a cab floor 7, a forward bulkhead 8 and rear and side walls 9 and 10, respectively. The forward bulkhead 8 conveniently forms part of forward bodywork 11 for the vehicle.

[0025] The lower cab 2 defines a connection plane 12 between the upper cab 3 and itself at a base 13 of windows 14 and 15 of the cab.

[0026] The permanent armour comprises steel armoured plate of between 4 and 6 millimetres thickness and is integral with the chassis 4. The permanent armour thus includes seam welded connections 16, 17 to chassis rails 18, 19, respectively. Seam welds 16 and 17 extend from upper edges 20, 21 of the chassis rails to forward ends 22 (left hand shown only) of the chassis rails and continue down the forward ends to weld the rails to a footwell 31 of the lower cab portion 2.

[0027] The lower cab portion also comprises an armoured engine cover 23. The engine cover provides protection for the occupants of the cab from the effects of mines or other attacks from below the vehicle. An armoured radiator duct 24 acts to narrow a frontal opening in the permanent armour which would otherwise offer vulnerability of the cab occupants to

attack from the front of the vehicle. FIG. 3 shows how the radiator duct narrows the frontal opening into the vehicle to an area which will be substantially occupied by the engine (not shown) of the vehicle in any event.

[0028] Referring to FIG. 1, doors 25 can extend armoured protection for the occupants up to the base 13 of the windows if armour is selected for the doors. Doors of any desired armoured capability may therefore be fitted to the permanent armour 2 according to the level of threat. It is envisaged however that non-armoured doors would be fitted to the permanent armour when a non-armoured upper cab 3 were to be used.

[0029] It will be noted that a forward bumper 26 is attachable directly to the lower cab portion 2 via brackets 27, 28 (see FIG. 4). Recovery or towing loads of the vehicle may be transmitted from shackles 29, 30 through the bumper 26, the brackets 27, 28 and the footwell 31 of the lower cab portion 2 into the chassis rails 18 and 19, and then via a series of butterfly beams 32, 33, 34, 35 and an all wheel drive transmission tunnel 36 to which the butterflies are connected to the wheels by wheel axles 37, 38. Only the front two axles are shown in FIG. 4.

[0030] The upper cab 3 is shown in FIGS. 1, 2 and 6. In all three cases the upper cab illustrated is of a non armoured construction. As can be seen most clearly in FIGS. 2 and 6, the upper cab 3 connects to the lower cab portion 2 at bases of windscreen pillars 39 and 40 and, in generally the same horizontal connection plane 12, along an upper edge 41 of rear and side walls 9, 10 of the lower cab portion 2. Connection is via locating dowels on the upper edge 41 which engage apertures 42, 43 in a lower edge 44 and pillar ends 45, 46, respectively of the upper cab 3. The upper cab 3 is secured in position via bolts (not shown). Two forward bolts engage forward holes 47, 48 (left hand only shown) in an upper flange 49 via through-bored holes 50, 51, 52, 53 in the windscreen pillars 39, 40. The upper cab 3 is also secured to the lower cab portion 2 via two lugs 54, 55 in the lower cab portion. These engage with the upper cab 3 via 4 bolts passing therethrough into holes 56, 57 (right hand side only shown) of the upper cab. The lower windscreen pillar connections and lug connections described are particularly strong in order to withstand roll over loads for the vehicle.

[0031] In order to strengthen the upper cab 3 against various vehicle roll over loads, A, B and C pillars 39, 40, 60, 61, 62, (left hand C pillar not shown) of the upper cab are formed as rollover hoops with roof members 64, 65 and 66 respectively.

[0032] The upper cab 3 defines an observation aperture 67 and is further reinforced by cross bracing 68, 69, 70, 71, 72, 73 and 74, to provide structural rigidity to the upper cab to withstand rollover loads. The construction of the upper cab 3 is of mild steel sheet 75 and mild steel tubing 76 with other structure provided as required.

[0033] It will be appreciated from the foregoing that the upper cab 3 may be removed from the lower cab portion 2 simply by withdrawing the bolts engaging the holes as previously described. It will be further appreciated that removal of the upper cab need not involve the disengagement of any electrical connections or removal of any pipework or the like as all major vehicle controls and seats are attached to the vehicle via the lower cab portion 2.

[0034] A fully armoured upper cab may be attached to the lower cab portion 2 in the same manner as the non-armoured upper cab described above. Armour similar to that illustrated

in FIG. 7 may be assembled as an upper cab of the same configuration as the non armoured upper cab illustrated in FIGS. 1, 2 and 6.

[0035] The load carrying module 5 may be attached to the chassis rails 18, 19 in a conventional bolted manner or may utilise quirk release attachments of a known kind.

[0036] It will be appreciated that the permanent armour 2 and the other chassis members 18, 19, 32, 33, 34, 35 and 36 combine, structurally, to provide an extremely rigid and robust chassis for the vehicle of the invention. The permanent armour 2 is of a fully welded construction and is thus inherently extremely rigid and strong. Where the permanent armour is structurally connected to the chassis rails, for example by welding them directly together, the height of the cab above the ground may be reduced, when compared to a conventional design. This allows the cab to be lower and the handling to be improved. Additional torsional rigidity is provided to the chassis by cross members 77, 78. It will be appreciated from the configuration shown in FIGS. 2 and 3 that a load carrying module may extend downwardly between the chassis rails 18, 19 in the region behind the cross member 77. This allows additional height within the load module, particularly to act as a footwell when personnel are being carried therein.

1. An armoured vehicle having an armoured driver's cab including seating and controls for at least engine, steering,

brakes and gears of the vehicle, the driver's cab including permanent armour and a removable optionally armoured element, wherein the removable element may be removed without disturbing the seating and controls.

2. An armoured vehicle as in claim 1 in which the permanent armour includes at least a floor of the cab.

3. An armoured vehicle as in claim 1 in which the permanent armour includes a forward bulkhead of the cab.

4. An armoured vehicle as in claim 3 in which the forward bulkhead includes external bodywork of the vehicle.

5. An armoured vehicle as in claim 1 in which the permanent armour includes rear and side walls of the cab.

6. An armoured vehicle as in claim 1 in which the permanent armour forms a structural part of a chassis of the vehicle.

7. An armoured vehicle as in claim 6 in which the permanent armour is structurally attached to two longitudinally extending chassis rails of the vehicle.

8. An armoured vehicle as in claim 7 in which the chassis rails are structurally attached to a longitudinally extending transmission tunnel adapted to provide longitudinal torsional stiffness to the chassis.

9. An armoured vehicle as in claim 1 in which the removable element is non armoured

10. An armoured vehicle as in claim 1 in which the removable element is armored.

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