

DESCRIPTION**Armoured vehicle**

The invention relates to an armoured vehicle with a safety cage accommodating the crew of the vehicle, comprising the features indicated in the preamble of claim 1.

Protected vehicles are faced with the problem to have a total weight being too high since the protection becomes heavier with increasing threat. According to the useful volume and protective level they weigh 30 to 50 tons. Medium-heavy wheeled vehicles up to 20 tons cannot be equipped with the highest level protection due to the problems of weight. This results in unintentional compromises. As a result, a variety of vehicles will be protected in a not particularly well-balanced manner, and e.g. have good protection against mines but only an average ballistic protection.

As a result of new sceneries, these vehicles are increasingly more subject to the threat caused by portable antitank firearms or bomb attacks. This requires a very heavy protection up to a reactive armouring whereby the problematic nature of weight is increasing. The required capability of aerial movement is often established in that the protection device itself is removable from the vehicle.

From DE 10 2004 006 819 A1 an armoured vehicle is known which is made up of several main assemblies. The safety cage is arranged within a supporting structure of the vehicle such that the shock waves occurring during the explosion of landmines, which act on the safety cage of the vehicle from below, will be buffered with respect to the persons inside the vehicle.

A vehicle with protection against the effect of a landmine is also disclosed in DE 10 2004 026 237 A1. A V-shaped and acutely formed safety cage, respectively, in the floor area is described. The figure relating to this embodiment then shows a double-walled construction.

From Jane's International Defence Review, September 2005, page 92, an exploded view of an armoured vehicle can be taken in which various modules of the vehicle are illustrated. On the occasion, it is explained that the V-shape of the vehicle floor area and the crew module, respectively, represents a better decrease of the effect of blast mines.

The object of the invention is to provide a preferably armoured vehicle such as a medium-heavy vehicle which ensures sufficient protection from mines as well as from shock waves of blasting charges or of ballistic missiles acting on the side walls, for the vehicle's crew inside the safety cage, also without any particularly additional weight expensive armour-platings.

According to the invention, this object is solved with the features of claim 1. Further particularly advantageous embodiments of the invention are disclosed in the subclaims.

The invention is based on the fact, that a best possible shape of the safety cage will be created by means of an alveolated cross-sectional shape. Such a shape, that is an essentially hexagonal cross section, is already illustrated in the article by Jane's. Then, the roof side and floor side walls of the safety cage substantially have a horizontal course while the side walls of the safety cage have a wedge-shaped course narrowing outwardly. Preferably, this angle is at 90°. In order to enable hanging in the safety cage in a simple manner into a supporting structure of the vehicle, the safety cage will be provided at the front and at the back of the roof with

protruding pockets, which are opened downwards and resting on the supporting structure of the vehicle preferably by means of deformable members.

As a result, the roof of the safety cage becomes longer than the cage itself. For placing the cage it is provided to shift the bearing points wide outwardly by means of which the arms of the supporting structure become just as wide as the roof of the cage. Further, for reinforcement of the extended roof, these are completed with metal sheets being vertically or obliquely arranged, or the like, which are then allowed to project beyond the arms of the supporting structure. Through this design are made so called pockets and ears, respectively. For optimum adaptation of the course of power flow between the supporting structure and safety cage these pockets are preferably fastened by means of metal sheets obliquely running into the side wall of the safety cage. In addition, it is possible to arrange further crushing members or buckling strength members inside the pockets in a weather-protected manner, protected from view and against NBC weapons. As a result, there is an added advantage, namely, such that the areas provided by the ears at the side on the cage roof can be used as ventilating openings and the like.

Because of the alveolated cross section of the entire safety cage, further not only the effect of shock waves from below and from the side will be ideally dissipated, but also a particularly rigid self-supporting structure of the safety cage will be created.

Based on this, to optimize the protection against mines, all openings such as doors and service flaps are put in the upper area of the safety cage wherein, in particular, they are not exposed to the effect of blast mines.

Moreover, in view of a place-saving and safe suspension of the safety cage inside the supporting structure it is provided that the supporting structure has a wedge-shaped course narrowing outwardly and being directed toward the floor of the vehicle, and which is adapted to the lower areas of the inclined side walls of the safety cage.

In addition to the optimized shape of the safety cage, this will be selected as small as possible complying with the ergonomic minimum values. Because of that, with predetermined maximum total weight of the vehicle, a greatest possible scope results for the weight associated with a high level protection from mines, protection against bomb attacks and protection against ballistic missiles.

In order to ensure optimum protection of the crew of the safety cage from the outside, it has been proved as suitable to provide the side walls on the exterior with a ballistic protection device and to arrange mine protection plates on the supporting structure exteriorly.

Moreover, it can be provided that in the lower area of the safety cage insulation and a fragmentation protection liner are arranged on the inside. These reduce the effect of penetrating secondary fragments.

Against threat of the crew upon the roof the safety cage roof still can be additionally provided with a special protection device.

Further details and advantages of the invention result from the following embodiments explained with the help of figures in which:

Figure 1 shows a perspective view of an armoured wheeled vehicle having a safety cage according to the invention;

Figure 2 shows a perspective view of the safety cage of the vehicle illustrated in Figure 1;

Figure 3 shows a perspective view of the safety cage illustrated in Figure 2 having additional protection elements being exteriorly and interiorly arranged;

Figure 4 shows a perspective view of the safety cage illustrated in Figure 2 which is received by a supporting structure of the vehicle illustrated in Figure 1;

Figure 5 shows a representation of a protruding pocket of the safety cage in a front view;

Figure 6 shows a side view of the pocket.

In Figure 1, reference numeral 1 indicates an armoured wheeled vehicle which comprises a safety cage 2 according to the invention, accommodating the crew of the vehicle. The safety cage 2 is an assembly of the main module which is composed of the cage and supporting structure. This main module is put together with a mover module and axle assembly to a vehicle and is supported inside a supporting structure 3 (Figure 4) of the vehicle 1. Then, in the illustrated embodiment, the size of the safety cage 2 is selected such that the crew may consist of one driver, one co-driver and four other crew members.

The safety cage 2 according to the invention substantially has a hexagonal cross section (Figure 2). Then, above and below a waist line 6 of about half the height of the safety cage 1, the side walls 4, 5 have an opposite slope β of appr. 45° , such that the two side walls 4, 5 of the safety cage 2 have a wedge-shaped

course narrowing outwardly with a wedge angle α of about 90° . Basically, an angle β of between 30° and 45° is useful, wherein the value of the angle of the wedge angle α is increasing.

So that the crew is able to use the interior 7 of the safety cage 2 sufficiently well, the roof-side and floor-side walls 8, 9 of the safety cage 2 preferably have a substantially horizontal course. On the other hand, the front and rear side walls 10, 11 are made inclined for the connection with the supporting structure 3 carrying the safety cage 2. Further, the supporting structure 3 has a narrowing wedge-shaped course being directed toward the floor 18 of the vehicle 1, and adapted to the lower areas 4', 5' of the inclined side walls 4, 5 of the safety cage 2.

The doorways 13 for entering the interior 7 are located in the upper area of the safety cage 2 to ensure optimum protection against mines.

The walls 4, 5 and 8-11 of the safety cage 2 advantageously consist of armour steel. As can be taken from Figure 3, the two side walls 4, 5 are further provided with a ballistic protection device 14. Moreover, the supporting structure 3 supporting the safety cage 2 is exteriorly provided with a mine protection device 15. Further, a liner (partition) 16 and an insulation 17 each are interiorly located on the side walls 4, 5 of the safety cage 2.

For hanging in into the supporting structure 3 (Figure 4), the safety cage 2 comprises protruding pockets 12 (see also Figure 2) at the front and at the back on the roof-side wall 8, which are opened downwardly and resting on the supporting structure 3 by means of which the safety cage 2 (Figure 2) can be hung into the supporting structure 3.

Because the safety cage 2 bears on transverse arms 19 of the supporting structure 3 (Figure 6) in the front and rear roof areas, the roof 8 of the safety cage 2 is made longer than the safety cage 2. The arms 19 of the supporting structure 3 are preferably just as wide as the roof 8 of the safety cage 2. Additional reinforcement can be provided such as by means of side metal sheets 20 (Figure 6) being vertically or obliquely arranged. If these formed pockets 12 will be fastened by means of metal sheets 21 obliquely running into the side wall of the safety cage 2, then the course of the power flow between the supporting structure 3 and safety cage 2 can be adapted.

From these pockets 12 and ears, respectively, protected areas 22 result on the cage roof at the side which can be used for vent openings or the like.

It is to be understood, that within the scope of the invention, namely, hanging in a main module or cage, etc. into a vehicle by means of pockets etc., the protruding pockets 12 can be modified, and are individually adaptable to the supporting structure of the vehicle.

List of reference numerals

- 1 wheeled vehicle, vehicle
- 2 safety cage
- 3 supporting structure
- 4, 5 side walls
- 4', 5' lower areas
- 6 waist line
- 7 interior
- 8 (roof side) wall
- 9 (floor side) wall
- 10 (front side) wall
- 11 (rear side) wall
- 12 pocket (ear)
- 13 doorway, opening
- 14 ballistic protection device
- 15 mine protection device
- 16 partition wall
- 17 insulation
- 18 floor
- 19 arm of the supporting structure
- 20 metal sheet
- 21 metal sheet
- 22 protected area

- α wedge angle
- β tilt angle of the floor side walls

Claims

1. Armoured vehicle with a safety cage (2) accommodating the crew of the vehicle (1), wherein said safety cage (2) is elastically supported in a supporting structure (3) of said vehicle (1), **characterized in that** said safety cage (2) is provided on the roof side at the front and at the back with protruding pockets (12), which are opened downwards and resting on said supporting structure (3) of said vehicle (1) by means of deformable members.
2. Armoured vehicle according to claim 1, **characterized in that** said safety cage (2) bears on transverse arms (19) of said supporting structure (3), in the front and rear roof areas.
3. Armoured vehicle according to claim 1 or claim 2, **characterized in that** said arms (19) of said supporting structure (3) is just as wide as the roof (8) of said safety cage (2).
4. Armoured vehicle according to any one of claims 1 to 3, **characterized in that** additional reinforcement can be created by means of side metal sheets (20) being vertically or obliquely arranged.
5. Armoured vehicle according to any one of claims 1 to 4, **characterized in that** said pockets (12) are fastened by means of metal sheets (21) running obliquely into the side wall of said safety cage (2).
6. Armoured vehicle according to any one of claims 1 to 5, **characterized in that** said safety cage (2) has a hexagonal cross section, wherein said roof-side and floor-side walls

(8, 9) of said safety cage (2) have substantially a horizontal course, and said side walls (4, 5) have a wedge-shaped course narrowing outwardly.

7. Armoured vehicle according to claim 6, **characterized in that** said wedge-shaped course is defined by the slope (β) which can be between 45° and 30° .
8. Armoured vehicle according to any one of claim 1 to 7, **characterized in that** said supporting structure (3) has a narrowing wedge-shaped course being directed toward the floor (18) of the vehicle (1), and which is adapted to the lower areas (4', 5') of the inclined side walls (4, 5) of the safety cage (2).
9. Armoured vehicle according to any one of claims 1 to 8, **characterized in that** said side walls (4, 5) of said safety cage (2) are provided with a ballistic protection device (14) on the exterior.
10. Armoured vehicle according to any one of claims 1 to 9, **characterized in that** a mine protection device (15) is exteriorly arranged on said supporting structure (3) supporting said safety cage (2).
11. Armoured vehicle according to any one of claims 1 to 10, characterized in that the openings (13) being lockable by means of doors or flaps for entering and/or servicing said safety cage (2) are arranged in the area of said side walls (4, 5) above the waist line (6).