ARMORED VEHICLE WITH BLAST DEFLECTING HULL

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Filed: Dec. 21, 2006

ABSTRACT

Disclosed herein is an armored vehicle that includes a frame supported by one or more wheels, a hull affixed to the frame having a generally diamond shaped vertical cross section, the hull including a plurality of armored panels; one or more bullet proof windows; and an air intake designed to prevent debris from entering an engine compartment, wherein the generally diamond shape of the hull deflects energy from sources that are not normal to a hull surface away from the hull to minimize damage to the hull.
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CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority of U.S. Provisional Patent Application No. 60/753,000 filed 22 Dec. 2005, the entire contents of which is hereby incorporated by reference.

TECHNICAL FIELD

[0002] The present invention relates, generally, to armored personnel carriers, and, more particularly, to an armored personnel carrier with a generally diamond shaped hull.

BACKGROUND OF THE INVENTION

[0003] Armored personnel carriers or armored vehicles are used in a wide variety of applications that require the safe and secure transportation of one or more individuals through dangerous environments. For example, armored SWAT vehicles may be used to transport police officers in tactical situations or armored vehicles may be used to transport individuals in need of high security through dangerous environments. The most common use of armored vehicles, often referred to as an Armored Personnel Carrier or APC, is in military applications. Throughout this description, the APC will largely be discussed in terms of military applications, however, those of ordinary skill in the art will recognize that APC’s may be utilized in a variety of scenarios. APCs are employed by the military to transport infantry and supplies to and from the battlefield. APCs are generally light armored vehicles that have little firepower and are designed to move troops quickly and safely.

[0004] Various APCs have been used to transport infantry since World War I, but changing battle environments demand an updated APC design. The first APC, the British Mark V, was developed during World War I was essentially a tank with a small passenger compartment. As the APC evolved from a tank design, most APC designs were designed as tracked vehicles. After the conclusion of World War II various specialized APCs were designed, including the US M-113 and the Soviet BTR-40, which was a wheeled design.

[0005] Traditionally, APCs have been designed to withstand small arms fire and shell fragments. Accordingly, the armour on APCs is usually composed of simple steel or aluminum, sufficient only for protection against small arms fire and most shell fragments. The armour of a typical APC will not withstand an attack by most types of anti-tank weapons; in fact, just about any type of anti-tank weapon can defeat the armour of a typical APC.

[0006] While current APC armours are sufficient for traditional uses of the APCs, design changes are needed to adapt the APC for use in current war environments, such as in Iraq. One of the greatest threats to APCs in Iraq are the roadside bombs which are being encountered in large numbers. Roadside bombs are typically detonated by a pressure switch that is activated when ran over by an APC or the roadside bombs are remotely detonated when an APC is close to the bomb. Current APCs are not built specifically to withstand attacks by roadside bombs and perform poorly in response to such attacks for several reasons. Current designs of typical APC are particularly vulnerable to bombs that are detonated below the hull of the APC because the APCs were primarily designed to defend against lateral small arms fire. Detonations under the hull can cause serious damage to the undercarriage of the APC, which may have less armament than the sides of the APC. Additionally, detonations of bombs below the APC may cause the APC to flip over and become immobile.

[0007] Accordingly, there is a need in the art for an APC that is able to withstand roadside bombs and other challenges present in today’s war environment.

BRIEF SUMMARY OF THE INVENTION

[0008] Disclosed herein is an improved armored vehicle that has a generally diamond shaped hull. The sides of the diamonded shaped hull are substantially non-vertical surfaces that are designed to minimize the impact of lateral fire on the hull. Additionally, the diamonded shaped hull directs blast forces emanating from beneath the hull away from the hull of the armored personnel carrier. The deflection of blast forces minimizes the impact that roadside bombs have on the APC and prevent the APC from flipping over from a roadside bomb. Furthermore, the improved personnel carrier includes one or more blast plates that are mounted on the exterior of the hull of the APC which provide an additional layer of protection for the APC.

[0009] In one embodiment the armored vehicle includes a hull having a generally diamond shaped vertical cross section, the hull comprising a plurality of armored panels and one or more blast plates affixed to an exterior of the hull, wherein the generally diamond shape of the hull deflects energy from sources that are not perpendicular to a hull surface away from the hull to minimize damage to the hull.

[0010] In another embodiment the armored vehicle includes a lower portion including a first and second lower armored panel, wherein the first and second lower armored panels are disposed at an angle ranging from approximately twenty-five degrees to seventy-five degrees from vertical and a upper portion including a first and second upper armored panel, wherein the first and second upper armored panel are disposed at an angle ranging from approximately twenty-five degrees to seventy-five degrees from vertical.

[0011] These and other objects, features and advantages of the present invention will become more apparent upon reading the following specification in conjunction with the accompanying drawing figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The subject matter that is regarded as the invention is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other objects, features, and advantages of the invention are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

[0013] FIG. 1 illustrates a side view of an improved armored personnel carrier in accordance with an exemplary embodiment of the invention;

[0014] FIG. 2 illustrates another side view of the improved armored personnel carrier in accordance with another exemplary embodiment of the invention;
FIG. 3 illustrates a rear view of the improved armored personnel carrier of FIG. 1 in accordance with an exemplary embodiment of the invention;

FIG. 4 illustrates a rear view of the improved armored personnel carrier of FIG. 2 in accordance with an exemplary embodiment of the invention;

FIG. 5 illustrates a front view of an air-intake of the improved armored personnel carrier in accordance with an exemplary embodiment of the invention;

FIG. 6 illustrates a cross-sectional view of the air-intake of FIG. 5 in accordance with an exemplary embodiment of the invention;

FIG. 7 illustrates an side view of an improved armored personnel carrier in accordance with another exemplary embodiment of the invention;

FIG. 8 illustrates a cross-sectional view of the improved armored personnel carrier of FIG. 7 in accordance with an exemplary embodiment of the invention; and

FIG. 9 illustrates a cross-sectional view of an armored panel in accordance with an exemplary embodiment of the invention.

The detailed description explains the preferred embodiments of the invention, together with advantages and features, by way of example with reference to the drawings.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is an improved armored personnel carrier that is designed to better handle the challenges presented in a variety of hazardous conditions. Such conditions may include unsafe urban situations, police actions, military activities, and battlefields, such as the current situation in Iraq. While much of the present disclosure describes challenges faced in war environments, those skilled in the art will recognize that the scope of the present invention is not so limited.

The APC described herein has a generally diamond shaped hull, e.g., the sides of the hull are substantially non-vertical surfaces. The angled sides of the hull are designed to minimize the impact of lateral fire on the hull and to reduce the impact of a roadside bomb on the APC. For example, the diamond shaped hull deflects lateral fire impacting the sides of the APC and also directs blast forces emanating from beneath the hull away from the hull of the armored personnel carrier. By deflecting blast forces emanating from beneath the hull the diamond shaped design minimizes the impact that roadside bombs have on the APC and reduces the chances that the APC will flip over from a roadside bomb attack.

Referring now to FIG. 1, a side view of an improved armored personnel carrier 100 in accordance with an exemplary embodiment of the present invention is illustrated. The APC 100 includes a hull 102 mounted on a frame 104 that is supported by wheels 106. The hull 102 includes several armored panels 108 that completely encase the APC 100. In exemplary embodiments, the armored panels 108 are designed to encase the engine compartment, the passenger compartment, and the undercarriage of the APC 100. The front of the APC 100 includes an air intake 110 that is designed to allow air into the engine compartment while preventing ammunition and other debris from entering the engine compartment.

In exemplary embodiments, the hull 102 may include a plurality of windows 112 that are made of a suitably durable material to withstand impact from munitions and other projectiles. Such suitable materials may include, but are not limited to, bullet proof glass, plexiglass, and the like. In addition, the wheels 106 may be filled with a gel, foam, or other material that prevents the wheel from going flat upon being punctured. Suitable materials may include, but are not limited to, ¾" AR5-500 Brinnell; ¼" AR5-500 Brinnell; ¼" spall liner, air gaps, tactical paint coating, other composite materials, and the like. The APC 100 may include one or more rear doors 114 and one or more side doors to allow personnel to enter and exit the APC 100. FIG. 2 illustrates the APC 100 with the rear door 114 in its open position. In alternative exemplary embodiments, the rear door 114 may be a vertical hinge door rather than the horizontal hinging door as shown.

FIG. 3 illustrates a rear view of the APC 100 in accordance with an exemplary embodiment of the present invention. As shown, the hull 102 of the APC 100 has a generally diamond shaped cross-section. The diamond shape of the hull 102 is constructed with sloped or angled sides and is structurally sound to withstand blast forces and arms fire received from a variety of sources. The sloped sides may reduce the likelihood of the APC 100 experiencing direct, close to perpendicular, or ninety degree, impact from incoming fire. Such sloped sides may deflect arms fire and blast forces and reduce the impact on the APC 100. The sloped sides are implemented in a diamond shape that is integrated throughout the APC 100 including, but not limited to the undercarriage, sides, top, front, and rear of the APC. Alternatively, other shapes are available that include sloped sides throughout a cross section of the APC. Such alternative shapes may be used and are consistent with the scope of the present invention. FIG. 4 illustrates an exemplary embodiment of the APC 100 with the rear door 114 in the open position.

When a road side bomb is detonated beneath a standard APC, the blast forces act against the bottom of the APC and stress the APC hull. Often, these blast forces are trapped in various cavities under the APC, which place great forces on the hull and may create rollover problems. In exemplary embodiments, the diamond shape of the hull 102, specifically the lower portion of the hull 102, is designed to deflect blast forces away from the hull 102 of the APC 100. Additionally, the hull 102 minimizes horizontal surfaces and covers cavities that may catch blast forces that come from beneath the hull 102. In exemplary embodiment, armored plates are placed over any cavities or protrusions that otherwise may catch blast forces emanating from below the hull 102.

In one example, if a roadside bomb was detonated under the hull 102, the shape of the hull 102 would deflect the majority of the force from the blast away from the hull 102 such that the damage to the hull 102 would be minimal. The diamond shaped undercarriage slopes upward toward the sides of the APC and directs the blast forces out from under the APC. Additionally, armored plates on the bottom of the hull prevent blast forces from being caught by cavities.
in, or protrusions extending, from the hull. These design elements combine to reduce both the damage to the APC from a roadside bomb and the probability that the APC will be overturned by a roadside bomb.

[0030] Turning now to FIG. 5, the air intake 110 in accordance with an exemplary embodiment of the present invention is illustrated. The air intake 110 is designed to reduce the effectiveness of a frontal attack on the engine compartment of the APC by preventing munitions and other projectiles from reaching the engine of the APC. The air intake 110 includes a plurality of horizontal openings 116 and a plurality of armored cross bars 118. The armored cross bars 118 are constructed of a durable material designed to withstand small arms fire. The horizontal openings 116 are large enough to enable a sufficient amount of air to pass through to effectively support the operation of the engine. In one embodiment, the air intake 110 is sloped to minimize the risk of a direct, or ninety degree, impact on the air intake 110.

[0031] FIG. 6 is a cross sectional view of the air intake 110 shown in FIG. 5 taken along line I. The air intake 110 includes a second protective layer 120 that includes another plurality of armored cross bars 122 which are disposed such that debris that passes through the opening of the outer layer of the air intake 110 will impact the armored cross bars 122. Additionally, the second protective layer 120 includes a plurality of horizontal openings 124 sufficient to enable a suitable amount of air to pass through to effectively support the operation of the engine. The horizontal openings 124 are located on the second protective layer 120 such that they are behind the armored cross bars 118 on the outer layer of the air intake 110. The use of the two layers of armored cross bar 118 and 122 in the air intake 110 prevent ammunition and debris from entering the engine compartment and interfering with the operation of the engine of the APC 100.

[0032] Turning now to FIGS. 7 and 8, another exemplary embodiment of an armored personnel carrier 200 is illustrated. In one embodiment, a wheel 202 on the side of the APC 200 may have one or more side blast plates 204 that are designed to provide further protection for the wheels 202 of the armored personnel carrier 200. For example, the side blast plates 204 may be provided to defend against lateral arms fire. The blast plates 204 may be effective in stopping arms fire from reaching the hull 206 of the APC 200 and incoming explosive rounds may detonate upon contact with the blast plate 204 thereby preventing detonation in contact with the hull 206. Such premature detonation may reduce the impact on the hull 206 and may help prevent projectiles from penetrating the hull 206 of the APC 200. In exemplary embodiments, one or more blast plates 204 may be used to cover a portion of or an entire side of the hull 206. For example, the blast plates 204 may be used to cover only the portion of the hull 206 that includes the wheels 202. The blast plates 204 are affixed to the hull 206 such that the surface of the blast plates 204 are not parallel with the surface of the hull 206, which further reduces the chances of a direct impact with both the outer layer of armor, blast plate 204, and the inner layer of armor, hull 206.

[0033] In order to avoid creating a cavity in the APC 200 that is susceptible to trapping blast forces, a gap 208 may be provided between the hull 206 and the blast plates 204. As discussed above, blast forces from explosives detonated below the APC 200 present a great threat, especially if the blast forces are trapped under the APC 200. In order to avoid trapping these forces, an egress for blast forces to escape from under the APC 200 with minimum damage to the APC 200 may be provided. In accordance with an exemplary embodiment of the present invention, the egress may be provided by leaving gap 208 between the sloped sides of the hull 206 and the blast plates 204. In such an embodiment, when a bomb detonates below the APC 200, the blast forces are directed up the sloped side of the hull 206 and through the gap 208. Preferably, the gap is of sufficient width to allow the blast force to escape easily. Such a gap may preferably be one to four inches in width. Additionally, the blast plates 204 may be mounted to the hull 206 with one or more blast-away bolts 210 that are designed to allow the blast plate 204 to separate from the hull 206 of the APC 200 in the event that the gap 208 does not provide sufficient egress for blast forces.

[0034] In another exemplary embodiment, the blast plates 204 may be affixed to the hull 206 by a hinge, which allows the blast plate 204 to swing open to vent blast forces emanating from beneath the hull 206. Additionally, the APC may also include one or more horizontal stabilization bars that are affixed to the hull 206, which prevent the blast plates from impacting the hull 206. For example, the blast plates 204 may be affixed to the hull 206 with a hinge extending along the top horizontal edge of the blast plate 204 and the horizontal stabilization bars may be affixed to the hull 206 such that during normal operation an interior surface the blast plates 204 rests against the horizontal stabilization bars. During a roadside bomb attack, the blast forces force the blast plate 204 to pivot away from the vehicle and vent the blast forces, however, during lateral fire the horizontal stabilization bars prevent the blast plate 204 from impacting the hull 206. In exemplary embodiments, to further stabilize the hull 206, vertical stabilization plates 210 may be disposed inside the hull 206 to reinforce the joint of a lower armored panel and an upper armored panel.

[0035] Referring now to FIG. 9, a cross sectional view of the armored panel 108 in accordance with an exemplary embodiment of the invention is illustrated. In exemplary embodiments, the armored panels 108 are multi-layered and the various layers are constructed of different materials. In one embodiment, a first layer 126 of the armored panel 108 is constructed of steel or another suitable metal alloy material. A second layer 128 of the multi-layered armored panel 108 is textile designed to prevent spalling of the steel or metal alloy that may occur as a result of an impact to the armored panel. In addition to metal alloys and textiles, the armored panels may include a third layer 130 that is constructed of suitable a ceramic material. In one exemplary embodiment, the armored panel 108 also include a fourth layer 132 that is constructed of steel or another suitable metal alloy material. The fourth layer 132 may be the constructed of the same or different material as the first layer 126. Likewise, the fourth layer 132 may have the same or different thickness that the first layer 126. In other exemplary embodiments the armored panel 108 may also include additional layers of metal, textiles, ceramics, and open space, or air, layers to provide additional protection.

[0036] Whereas the present invention has been described in detail it is understood that variations and modifications can be effected within the spirit and scope of the invention,
as described herein before and as defined in the appended claims. The corresponding structures, materials, acts, and equivalents of all mean-plus-function elements, if any, in the claims below are intended to include any structure, material, or acts for performing the functions in combination with other claimed elements as specifically claimed.

What is claimed is:

1. An armored vehicle comprising:
   a hull having a generally diamond shaped vertical cross section, the hull comprising a plurality of armored panels; and
   one or more blast plates affixed to an exterior of the hull, wherein the generally diamond shape of the hull deflects energy from sources that are not perpendicular to a hull surface away from the hull to minimize damage to the hull.

2. The armored vehicle of claim 1, wherein the plurality of armored panels have a multi-layered construction.

3. The armored vehicle of claim 2, wherein a first layer of the armored panel is steel or a suitable metal alloy and a second layer of the armored panel is a textile designed to prevent the spawling of the first layer resulting from an impact.

4. The armored vehicle of claim 1, wherein at least a portion of the plurality of armored panels are disposed on an undercarriage of the armored vehicle.

5. The armored vehicle of claim 1, further comprising an air intake designed to prevent debris from entering an engine compartment of the armored vehicle.

6. The armored vehicle of claim 5, wherein the air intake includes an exterior layer and an interior layer each comprising a plurality of armored cross bars and a plurality of horizontal openings, wherein the armored cross bars on the exterior layer are disposed in front of the horizontal openings on the intermediate layer and the horizontal openings on the outer layer are disposed in front of the armored cross bars on the interior layer.

7. The armored vehicle of claim 1, wherein a gap is disposed between the one or more blast plates and the hull of the armored vehicle, the gap sufficient for venting blast forces emanating from beneath the hull.

8. An armored vehicle hull comprising:
   a lower portion including a first and second lower armored panel, wherein the first and second lower armored panels are disposed at an angle ranging from approximately twenty-five degrees to seventy-five degrees from vertical; and
   a upper portion including a first and second upper armored panel, wherein the first and second upper armored panel are disposed at an angle ranging from approximately twenty-five degrees to seventy-five degrees from vertical.

9. The armored vehicle of claim 8, further comprising an air intake located on a front of the armored vehicle designed to prevent debris from entering an engine compartment of the armored vehicle, wherein a shape of the armored hull deflects energy from sources that are not normal to a hull surface away from the hull to minimize damage to the hull.

10. The armored vehicle of claim 8, wherein the first and second lower and upper armored panels have a multi-layered construction.

11. The armored vehicle of claim 10, wherein a first layer of the armored panels are steel or a suitable metal alloy and a second layer of the armored panels are a textile designed to prevent the spawling of the first layer resulting from an impact.

12. The armored vehicle of claim 8, wherein the air intake includes an exterior layer and an interior layer each comprising a plurality of armored cross bars and a plurality of horizontal openings, wherein the armored cross bars on the exterior layer are disposed in front of the horizontal openings on the intermediate layer and the horizontal openings on the outer layer are disposed in front of the armored cross bars on the interior layer.

13. The armored vehicle of claim 8, further comprising one or more blast plates mounted on an exterior surface of the armored hull, wherein the blast plates at least partially cover at least a portion of the plurality of the wheels.

14. The armored vehicle of claim 13, wherein the one or more blast plates are mounted on the exterior surface of the armored hull such that a gap exists between the one or more blast plates and the exterior surface.

15. The armored vehicle of claim 13, wherein the one or more blast plates are mounted on the exterior surface of the armored hull with a plurality of blast-away bolts that are designed to allow the one or more blast plates to separate from the armored hull as a result of sufficient blast forces.

16. A multi-layered armored panel comprising:
   a first layer constructed of steel;
   a second layer disposed on an interior surface of the first layer, the second layer constructed of an textiles suitable to prevent spalling of the first layer; and
   a third layer disposed on an interior surface of the second layer, the third layer constructed of a ceramic material.

17. The multi-layered armored panel of claim 16, wherein the second layer is directly disposed on the first layer.

18. The multi-layered armored panel of claim 17, wherein an open space layer is provided between the second layer and the third layer.

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