(12) STANDARD PATENT (11) Application No. **AU 2018203637 B2**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
An active protection system

(51) International Patent Classification(s)
F41H 11/02 (2006.01)

(21) Application No: **2018203637** (22) Date of Filing: **2018.05.23**

(43) Publication Date: **2018.06.14**
(43) Publication Journal Date: **2018.06.14**
(44) Accepted Journal Date: **2019.07.11**

(62) Divisional of:
2013245516

(71) Applicant(s)
Plasan Sasa Ltd.

(72) Inventor(s)
YESHURUN, Yehoshua;ZIV, Dan

(74) Agent / Attorney
Griffith Hack, GPO Box 1285, MELBOURNE, VIC, 3001, AU

(56) Related Art
US 2012/0217301 A1
US 2011/0127328 A1
WO 2010/029530 A1
VALPOLINI P: "ACTIVE ARMOUR PROTECTION", ARMADA INTERNATIONAL, ZURICH, CH, VOL. 34, NO. 3, 1 JUNE 2010
US 7684020 B1
US 2010/0026554 A1
US 2011/0204145 A1
US 2009/0266226 A1

2018203637 23 May 2018

ABSTRACT

A system for detecting an incoming threat, comprising:

a. a radio frequency (RF) system configured for receiving an RF signal generated by an electromagnetic pulse associated with engine ignition of the incoming threat and providing an output data being associated with the RF signal, being used for at least one of the following: detecting launch of the incoming threat and determining the type of the incoming threat;

b. a radar system configured for providing an output data associated with the incoming threat, being used at least for tracking the incoming threat after the detection of its launch; and

c. a controlling unit configured for controlling the operation of the RF system and the radar system.

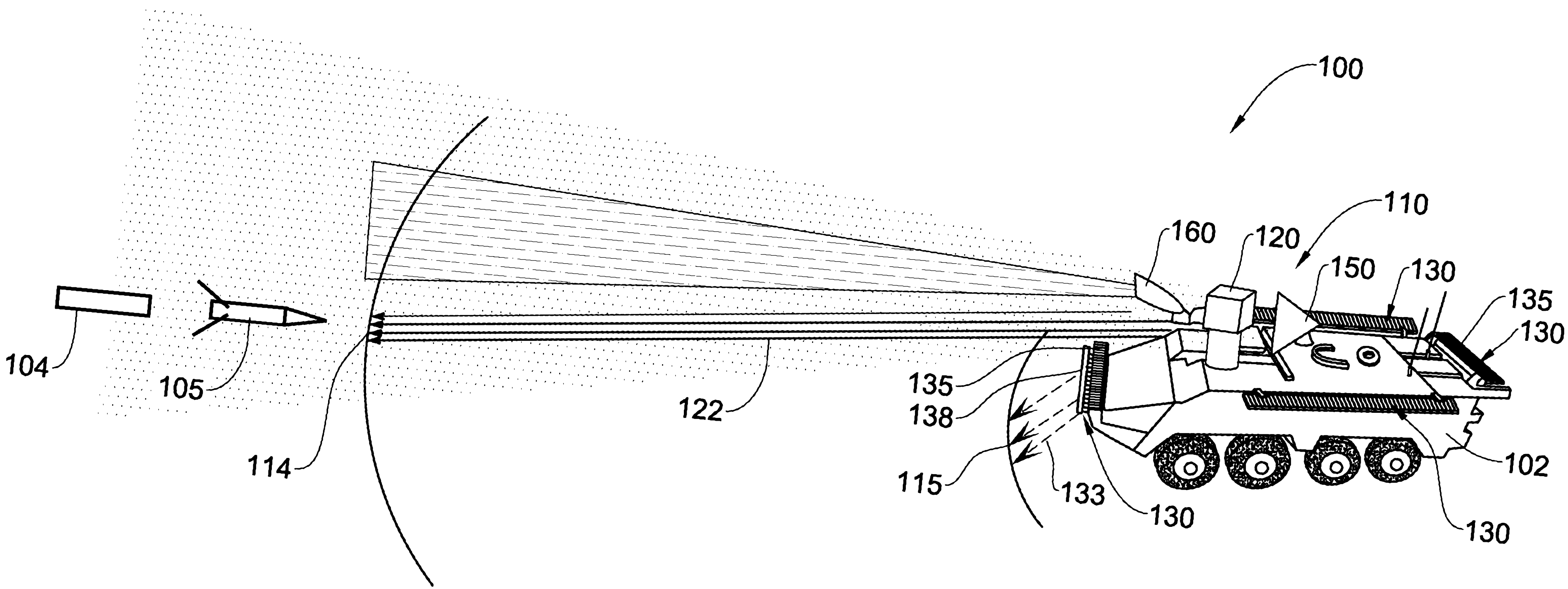
100
110
160
120
150
130
135
130
135
138
115
133
130
102
130
122
114
105
104

Fig. 2

AN ACTIVE PROTECTION SYSTEM

This application is a divisional application of Australian Application No. 2013245516, the original disclosure of which is incorporated herein by reference.

FIELD OF THE DISCLOSED SUBJECT MATTER

The present disclosed subject matter is concerned with defense systems and more specifically with active protection systems.

BACKGROUND OF THE DISCLOSED SUBJECT MATTER

An active protection system is related to protection systems which actively prevent sensor-based or other incoming threats from acquiring and/or destroying a target. The active protection system can protect soldiers, vehicles, buildings, military base and other platforms from large variety of threats.

Electronic countermeasures that alter the electromagnetic, acoustic or other signature(s) of a target thereby altering the tracking and sensing behavior of an incoming threat (e.g., a guided missile) are designated soft kill measures.

Measures that physically counterattack an incoming threat thereby destroying/altering its payload/warhead in such a way that the intended effect on the target is severely impeded are designated hard kill measures. The hard kill measures generally refer to measures taken in the so-called "end-game" shortly before a warhead/missile hits its target. The hard kill measure in general physically affects the incoming warhead/missile by means of either blast and/or fragment action. The active protection system, using a hard kill measure, is operated by detecting the incoming threat and killing it before it hits the target. The detection of the coming threats can be based on radar detection systems that provide information related to the incoming threat.

Different types of hard kill interception systems are known in the art. The killing interception of one type interception systems can occur at a far distance from the target, for example, between 10 to 100 meter. The killing interception of another type of interception system can occur close to the target's wall, for example, at a distance of between 1 to 5 meter. Each type of the hard killing interception systems has benefits and limitations regarding the cultural damage, the impact on the target, the protection threats level, the cost, the killing probability, reliability, weight and more.

SUMMARY OF THE DISCLOSED SUBJECT MATTER

The presently disclosed subject matter, in accordance with one aspect, provides a system for detecting an incoming threat, comprising:

a radio frequency (RF) system configured for receiving an RF signal generated by an electromagnetic pulse associated with engine ignition of the incoming threat and providing an output data being associated with the RF signal, being used for detecting launch of the incoming threat and determining the type of the incoming threat;

a radar system configured for providing an output data associated with the incoming threat, being used at least for tracking the incoming threat after the detection of its launch and the determination of its type; and

a controlling unit configured for controlling the operation of the RF system and the radar system, wherein the controlling unit is configured for receiving and analyzing the output data from the RF system for detecting launch of the incoming threat and determining the type of the incoming threat at least prior to initiating the operation of the radar system.

In accordance with another aspect, provides a method for detecting an incoming threat, comprising:

a. providing a detection system comprising: a radar system; a radio frequency (RF) system; and a controlling unit configured for controlling the operation of the RF system and the radar system;
b. receiving by said RF system an RF signal generated by an electromagnetic pulse associated with engine ignition of the incoming threat;
c. receiving from said RF system, in said controlling unit, an output data being associated with the RF signal, and being used for detecting launch of the incoming threat and determining the type of the incoming threat;
d. analyzing, by said controlling unit, said output data from the RF system for: detecting launch of the incoming threat and determining the type of the incoming threat;

e. initiating, by said controlling unit, operation of the radar system after the detection of launch of the incoming threat and determination of the type of the incoming threat;

f. receiving from said radar system, in said controlling unit, an output data being associated with the incoming threat; and

g. analyzing, by said controlling unit, said output data from the radar system for tracking the incoming threat.

The existence of two types of countermeasure arrangements, i.e., the first and the second countermeasure arrangements, within one active protection system allows this system to intercept a much wider variety of types of threats as opposed to the case, where only one of these countermeasure arrangements is used in an active protection system. The first countermeasure arrangement constitutes a first layer of active protection, and the second countermeasure arrangement constitutes a second layer of active protection. The combination of these two layers of active protection against an incoming threat within one active protection system allows obtaining much more accurate interception results, a reduced collateral damage, multi hit capability, high reliability, and reduced costs. The costs can be saved, for example, when instead of using an expensive countermeasure against a small threat, a much cheaper countermeasure is chosen and used.

The active protection system of the presently disclosed subject matter can provide protection in a wide variety of combat scenarios such as: urban warfare, open terrain warfare, and rural areas.

It should be indicated that if the threat is of the kind that produces a new threat while being intercepted (e.g., shrapnel), this new threat is considered to be different from the original threat.

The term **'platform'** refers hereinafter to an object to be protected from a potential threat, and can be, for example, one of the following: a ground vehicle, a lightweight vehicle, an armored personal carrier, a tank, an airplane, a helicopter, an unmanned aerial vehicle, and a war ship.

The term **'threat'** refers hereinafter to any known type of an object that can be dangerous for the platform, and can be, for example, one of the following: an explosively formed penetrator (EFP), an explosive-driven fragment, a bullet, an indirect ammunition and bomblet; an anti-tank missile, a non-guided missile or rocket; a guided missile or rocket; a self-guided and maneuvering missile or rocket; a heat seeking missile or rocket; a radar lock missile or rocket; a laser guided missile or rocket; a short range missile or rocket; a shoulder missile or rocket; an RPG (Rocket Propelled Grenade); and a TOW (Tube-launched, Optically tracked, Wire-guided missile).

The term '**residual impact**' refers hereinafter to an impact of fragmented parts of threat which are created as a result of an interception of an incoming threat.

The term **'collateral damage'** refers to a situation in which an incidental damage of something that is different from the original target occurs. For example, a collateral damage can be caused to civilian property and non-combatant casualties when an active protection system intercepts an incoming threat.

The first countermeasure arrangement can be configured to countermeasure two or more incoming threats at the same time. The controlling unit can be further configured for analyzing at least the output data to determine the type of the incoming threat; and selecting the preferred countermeasure arrangement at least based on the determined type of the incoming threat.

The controlling unit can be further configured for analyzing at least the output data for detecting launch of the incoming threat and tracking the incoming threat.

The controlling unit can be further configured to base the selection of the preferred countermeasure arrangement on at least one of the following: the distance of the incoming threat from the platform; the expected residual impact of the determined type of the incoming threat if intercepted; the caliber of the determined type of the incoming threat; the weight of the determined type of the incoming threat; and the effectiveness of each of the first and second countermeasure arrangements against the determined type of the incoming threat.

The first countermeasure arrangement can be selected for incoming threats having an expected residual impact that is greater than the expected residual impact for which the second countermeasure arrangement is selected.

The controlling unit can be further configured for instructing the preferred countermeasure arrangement to intercept the incoming threat.

The first and second countermeasure arrangements can be hard kill systems, both mountable, optionally separately, on the platform.

The detection system can comprise a radar system at least for tracking the incoming threat.

The detection system can further comprise a radio frequency (RF) system operative at least prior to the operation of the radar system for at least one of the following: detecting launch of the incoming threat and determining the type of the incoming threat.

The controlling unit can be configured for initiating the operation of the radar system following the launch detection of the incoming threat.

The RF system can be configured for detecting launch of the incoming threat by identifying an electromagnetic pulse associated with the engine ignition of the incoming threat.

The detection system can alternatively comprise an IR system which can be configured to replace the RF system, and to perform all the above operation, respectively.

The first countermeasure system can be configured for losing its capability to cause collateral damage after the far interception point.

The first countermeasure system can comprise an array of barrels, each configured to accommodate a plurality of countermeasures.

The countermeasures can be projectiles configured for dramatically losing kinetic energy after the far interception point.

The far interception point can be located farther than the near interception point, with respect to the platform.

The far interception point can be located at a distance of between about 2 meter to about 100 meter from the platform.

The second countermeasure arrangement can comprise a linear array of countermeasures configured for intercepting the incoming threat.

The countermeasures can be configured to be directed and launched in a plane substantially perpendicular to the line of flight of the incoming threat.

The countermeasures can be configured to be directed and launched in the vertically downward direction.

The second countermeasure arrangement can comprise an optical system, controllable by the controlling unit; the optical system being configured for: generating an optical zone; detecting passage of the incoming threat through the optical zone, thereby triggering the interception of the incoming threat by at least one countermeasure selected from the linear array of countermeasures and corresponding to the near interception point.

The near interception point can be located in close proximity to the platform's wall for reducing the collateral damage.

The near interception point can be located at a distance of between about 0.1 meter to about 10 meter from the platform.

The active protection system can further comprise a passive armor mounted on the walls of the platform.

The controlling unit can be configured for instructing the preferred countermeasure arrangement to intercept the incoming threat, while keeping the non-selected countermeasure arrangement inoperative against the same threat.

The presently disclosed subject matter, in accordance with another aspect, provides a platform having an active protection system as detailed above.

The presently disclosed subject matter, in accordance with another aspect, provides a method for detecting an incoming threat, comprising:

providing a detection system comprising: a radar system; a radio frequency (RF) system; and a controlling unit configured for controlling the operation of the RF system and the radar system;

receiving by said RF system an RF signal generated by an electromagnetic pulse associated with engine ignition of the incoming threat;

receiving from said RF system, in said controlling unit, an output data being associated with the RF signal;

analyzing, by said controlling unit, said output data from the RF system for at least one of the following: detecting launch of the incoming threat by the RF system and determining the type of the incoming threat;

receiving from said radar system, in said controlling unit, an output data being associated with the incoming threat; and analyzing, by said controlling unit, said output data from the radar system for tracking the incoming threat.

The method can further comprise a step of mounting the first and second countermeasure arrangements on the platform.

The method can further comprise steps of: analyzing by the controlling unit at least the output data to determine the type of the incoming threat; and performing the step of selecting the preferred countermeasure arrangement at least based on the determined type of the incoming threat.

The method can further comprise a step of analyzing by the controlling unit at least the output data at least for tracking the incoming threat.

The method can further comprise a step of basing the selection of the preferred countermeasure arrangement on at least one of the following: the distance of the incoming threat from the platform; the expected residual impact of the determined type of the incoming threat if intercepted; the caliber of the determined type of the incoming threat; the weight of the determined type of the incoming threat; and the effectiveness of each of the first and second countermeasure arrangements against the determined type of the incoming threat.

The step of selecting the first countermeasure arrangement can be based on incoming threats having an expected residual impact that is greater than the expected residual impact for which the second countermeasure arrangement is selected.

The method can further comprise a step of providing the detection system having a radar system at least for tracking the incoming threat.

The detection system can further comprise a radio frequency (RF) system operative at least prior to the operation of the radar system for performing at least one of the following steps: detecting launch of the incoming threat and determining the type of the incoming threat.

The method can further comprise a step of initiating the operation of the radar system following the launch detection of the incoming threat.

The method can further comprise a step of identifying an electromagnetic pulse associated with the engine ignition of the incoming threat, thereby detecting launch of the incoming threat.

The method can further comprise a step of determining at least one of the near interception point and far interception point by the controlling unit.

The second countermeasure arrangement can comprise an optical system, controllable by the controlling unit; and the method can further comprise steps of: generating an optical zone by the optical system; detecting passage of the incoming threat through the optical zone, thereby triggering the interception of the incoming threat by at least one countermeasure selected from a linear array of countermeasures and corresponding to the near interception point.

The method can further comprise a step of mounting a passive armor on the walls of the platform.

The method can further comprise a step of instructing, by the controlling unit, the preferred countermeasure arrangement to intercept the incoming threat, while keeping the non-selected countermeasure arrangement inoperative against the same threat.

The presently disclosed subject matter, in accordance with another aspect, provides a system for detecting an incoming threat, comprising:

a. a radio frequency (RF) system configured for providing an output data being associated with the incoming threat, being used for at least one of the following: detecting launch of the incoming threat and determining the type of the incoming threat;

b. a radar system configured for providing an output data associated with the incoming threat, being used at least for tracking the incoming threat after the detection of its launch; and

c. a controlling unit configured for controlling the operation of the RF system and the radar system.

The controlling unit can be configured for: receiving, from said RF system, said output data; and analyzing the output data from said RF system for at least one of the following: detecting launch of the incoming threat and determining the type of the incoming threat.

The analysis of the output data from said RF system can include application of pattern recognition techniques.

The output data from the RF system comprises data can be related to electromagnetic pulse associated with the engine ignition of the incoming threat.

The analysis of the output data from said RF system can further comprise performance of spectral analysis of the electromagnetic pulse.

The RF system can further be configured for tracking the incoming threat.

The radar system can further be configured for detecting the type of the incoming threat.

The presently disclosed subject matter, in accordance with another aspect, provides a method for detecting an incoming threat, comprising:

d. providing a detection system comprising: a radar system; a radio frequency (RF) system; and a controlling unit configured for controlling the operation of the RF system and the radar system;

e. receiving from said RF system, in said controlling unit, an output data being associated with the incoming threat;

f. analyzing, by said controlling unit, said output data from the RF system for at least one of the following: detecting launch of the incoming threat by the RF system and determining the type of the incoming threat;

g. receiving from said radar system, in said controlling unit, an output data being associated with the incoming threat; and

h. analyzing, by said controlling unit, said output data from the radar system for tracking the incoming threat.

The step of analyzing the output data from said RF system can comprise a step of applying pattern recognition techniques.

The output data from the RF system can comprise data related to electromagnetic pulse associated with the engine ignition of the incoming threat.

The step of analyzing the output data from said RF system can further comprise performing spectral analysis of the electromagnetic pulse.

The method can further comprise a step of analyzing, by said controlling unit, said output data from the RF system for tracking the incoming threat.

The method can further comprise a step of analyzing, by said controlling unit, said output data from the radar system for determining the type of the incoming threat.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the disclosed subject matter and to see how it may be carried out in practice, embodiments will now be described, by way of non-limiting examples only, with reference to the accompanying drawings, in which:

Fig. 1A is a schematic illustration of one known in the art active protection system mounted on an armored personnel carrier;

Fig. 1B is a schematic illustration of another known in the art active protection system mounted on an armored personnel carrier;

Fig. 2 is a schematic illustration of an active protection system mounted on an armored personnel carrier, according to one example of the presently disclosed subject matter;

Figs. 3A and **3B** are schematic illustration of a first countermeasure arrangement used in the active protection system of **Fig. 2**, according to one example of the presently disclosed subject matter;

Fig. 3C is a schematic illustration of a second countermeasure arrangement used in the active protection system of **Fig. 2**, according to one example of the presently disclosed subject matter;

Fig. 4 is a schematic representation of the main components of the active protection system of **Fig. 2**; and

Fig. 5 is a schematic block diagram of a method according to which the active protection system of **Fig. 2** is operated, according to one example of the presently disclosed subject matter.

DETAILED DESCRIPTION OF EMBODIMENTS

Attention is first directed to Figs. 1A and 1B of the drawings which schematically illustrates two examples of platforms in form of armored personnel carriers 10 and 20, each having a known in the art countermeasure arrangement mounted thereto.

The armored personnel carrier 10 of Fig. 1A has a countermeasure arrangement 12 which is configured to intercept an incoming threat at a near interception point, i.e., at a location which is proximal to the walls of the armored personnel carrier 10. The countermeasure arrangement 12 is related to the "on the wall" countermeasure arrangements which intercept the incoming threat as close as possible to the walls of the armored personnel carrier. The principle behind the operation of the "on the wall" countermeasure arrangements is that as close to the platform the interception is performed, the collateral damage that is caused to the platform's surrounding is reduced. One example of the countermeasure arrangement 12 is the 'Iron Curtain' system available by Artis, LLC. This system is described, for example, in US patent 7,684,020, which is incorporated herein by reference.

The countermeasure arrangement 12 can be used in short range combat scenarios, e.g., urban scenarios, and against incoming threat such as ATGM, EFP, Long rods and Tandem.

Differently from the armored personnel carrier 10, the armored personnel carrier 20 of Fig. 1B includes another type a countermeasure arrangement 22 which is configured to intercept an incoming threat at a far interception point, i.e., at a location which is not proximal to the walls of the armored personnel carrier 20. The countermeasure arrangement 22 is related to the "long distance" type of countermeasure arrangements which intercept the incoming threat in the air, at a distance which is not proximal to the armored personnel carrier 20. The countermeasure arrangement 22 can be suitable for use in combat scenarios such as open field warfare. The countermeasure arrangement 22 has an ability to encounter and intercept a large variety of threats, such as small and large missiles, and other types of serious threats. It is known that the collateral damage that can be caused by the countermeasure arrangement 22 is greater than the collateral damage that can be caused by the countermeasure arrangement 12. One example of the countermeasure arrangement 22 is the "fire wall" system available by Metal Storm Limited, Brisbane (AU).

Attention is now directed to Figs. 2 and 3, which schematically illustrate an active protection system 100 mounted on a platform in form of an armored personnel carrier 102, in accordance with one example of the presently disclosed subject matter. The active protection system 100 is configured for actively protecting the armored personnel carrier 102 from an incoming threat 105 which is launched from a launcher 104 towards the armored personnel carrier 102.

The active protection system 100 comprises a detection system 110 constituted by a radar system 150 and an RF system 160, a first countermeasure arrangement 120 constituting a first protective layer, a second countermeasure arrangement 130 constituting a second protective layer, and a controlling unit 140 (shown in Fig. 4) which operatively controls the operation of the active protection system 100. The first countermeasure arrangement 120 and the second countermeasure arrangement 130 are two external arrangements which are mounted on the armored personnel carrier 102 for providing an active protection thereto, as detailed below. The detection system 110 is operatively connected to the controlling unit 140, and the first and the second countermeasure arrangements 120 and 130 are also operatively connected to the controlling unit 140.

In general, the active protection system 100 is capable of detecting, identifying and tracking the incoming threat 105, and in response, selecting which of the first and the second countermeasure arrangements 120 and 130 is more suitable for intersecting the incoming threat 105, and afterwards, launching at least one countermeasure (e.g., a projectile, a bullet) from the selected countermeasure arrangements 120 and 130 toward the incoming threat 105. The countermeasure is configured for killing the incoming threat by directly hitting or discharging it.

The first countermeasure arrangement 120 is a hard kill arrangement related to the "long distance" type of countermeasure arrangements, such as the arrangement of Fig. 1B, and is configured to intercept the incoming threat 105 at a far interception point 114. The far interception point can be calculated by the controlling unit 140, and can be located at a distance of between about 2 meter to about 100 meter from the armored personnel carrier 130.

A detailed example of the first countermeasure arrangement 120 is presented in Figs. 3A and 3B. In particular, Fig. 3A illustrates a disassembled position of the first countermeasure arrangement 120, and Fig. 3B illustrates the first countermeasure arrangement 120 in operation. As shown in these figures, the first countermeasure arrangement 120 has an array of barrels 125, each configured to accommodate multiple countermeasures in form of projectiles 127 which can be directed along a path 122 during interception. According to a specific example, the projectiles 127 can be configured for dramatically losing kinetic energy after the far interception point 114.

The second countermeasure arrangement 130 is a hard kill arrangement related to the "on the wall" type of countermeasure arrangements, such as the arrangement of

Fig. 1A, and is configured to intercept the incoming threat 105 at a near interception point 115. The far interception point 114 is usually located farther than the near interception point 115, with respect to the armored personnel carrier 102. The near interception point 115 is located in close proximity to the wall of the armored personnel carrier 102 for reducing the collateral damage. The near interception point is located at a distance of between about 0.1 meter to about 10 meter from the armored personnel carrier 102.

A detailed example of the second countermeasure arrangement 130 is presented in Fig. 3C.The second countermeasure arrangement 130 comprises four linear arrays of countermeasure launchers 135, disposed at the surrounding of the armored personnel carrier 130. Each countermeasure launcher 135 is configured for accommodating at least one countermeasure in form of a bullet or a linear shaped charge that intercepts the incoming threat 105 in the near interception point 115. According to one example, the countermeasures can be directed and launched in the substantially vertically downward direction along a path 132, as shown in Fig. 3C. According to another example, the countermeasures can be directed and launched in the substantially downward direction along a path 133, as shown in Fig. 2.

According to other examples, the second countermeasure arrangement 130 is configured to direct and launch the countermeasures in a plane substantially perpendicular to the line of flight of the incoming threat.

The second countermeasure arrangement 130 further comprises a triggering optical system 138, controllable by the controlling unit 140 and configured for: generating an optical zone 134; detecting passage of the incoming threat through the optical zone, thereby triggering the interception of the incoming threat 105 by at least one countermeasure selected from the linear array of countermeasures 135 and corresponding to the near interception point.

The detection system 110 is responsible for providing to the controlling unit 140 real-time information in form of an output data (e.g., threat's location, threat's direction, threat's speed, threat's altitude, threat's angle) related to the incoming threat 105 during its way towards the armored personnel carrier 102. The output data is received from the radar system 150 and the RF system 160, and processed by the controlling unit 140, while each of this system is responsible for the following:

The RF system 160 is responsible for providing an output data according to which the launch of the incoming threat 105 can be detected. The detection of the incoming threat 105 is performed by the controlling unit 140 which identifies an electromagnetic RF pulse associated with the engine ignition of the incoming threat 105. The RF system 160 is additionally responsible for providing an output data according to which the type of the incoming threat 105 can be initially determined by the controlling unit 140 according to the above electromagnetic RF pulse.

In case of detection of the incoming threat 105, the controlling unit 140 initiates the operation of the radar system 150 which provides an output data useful for tracking the incoming threat 105. In addition, according to a specific example, the output data received from the RF system 160 can also be useful for tracking the incoming threat 105.

During the tracking of the incoming threat by the radar system 150, the controlling unit 140 constantly receives the output data from the detection system 110 and repeatedly analyzes this data. By analyzing the output data, the controlling unit 140 determines the type and the properties of the incoming threat 105, and accordingly selects a preferred countermeasure arrangement from the first and second countermeasure arrangements 120 and 130, with which the incoming threat is to be intercepted. In addition, following the selection of the preferred countermeasure arrangement, the controlling unit 140 determines the exact location of the respective far interception point 114 or the near interception point 115.

According to different examples of the presently disclosed subject matter, the selection of the preferred countermeasure arrangement can be based on at least one of the following criteria:

- the distance of the incoming threat 105 from the armored personnel carrier 102. For example, if the incoming threat is too close to the armored personnel carrier 102 to be intercepted by the first countermeasure arrangement 120, the second countermeasure arrangement 130 can be preferred;
- the expected residual impact of the determined type of the incoming threat if intercepted. For example, if the expected residual impact is high, the first countermeasure arrangement 120 can be preferred, since its far interception point 114 is farther from the armored personnel carrier 102 than the near

interception point 115 of the second countermeasure arrangement 130. In general, the first countermeasure arrangement 120 is selected for incoming threats having an expected residual impact that is greater than the expected residual impact for which the second countermeasure arrangement 130 is selected;

- the caliber of the determined type of the incoming threat. For example, if the caliber of the incoming threat is large, the first countermeasure arrangement 120 can be preferred since it can encounter more serious threats than the second countermeasure arrangement 130;
- the weight of the determined type of the incoming threat. For example, if the weight of the incoming threat is large, the first countermeasure arrangement 120 can be preferred since it can encounter more heavy threats than the second countermeasure arrangement 130; and
- the effectiveness of each of the first and second countermeasure arrangements against the determined type of the incoming threat. For example, if the incoming threat is an RPG, the second countermeasure arrangement 130 can be preferred.

Following the selection of the preferred countermeasure arrangement and the determination of the interception point, the controlling unit instructs the preferred countermeasure arrangement to intercept the incoming threat 105. It should be noted that the controlling unit 140 is configured for instructing the preferred countermeasure arrangement to intercept the incoming threat 105, while keeping the non-selected countermeasure arrangement inoperative against the same threat.

It should be indicated that the armored personnel carrier 102 can also include a passive armor mounted on its walls for providing an additional passive protection from the incoming threat or its shrapnel.

The controlling unit 140 is a computerized system with at least one processor and a memory which stores the software that is executable by the processor to control the operation of the active protection system 100.

Reference is now made to Fig. 5 which schematically illustrates a block diagram of a method for actively protecting a platform from an incoming threat, in accordance with one example of the presently disclosed subject matter.

The method 200 begins with step 210 which includes providing a mountable first countermeasure arrangement configured to intercept the incoming threat at a far interception point, and a mountable second countermeasure arrangement configured to intercept the incoming threat at a near interception point. This step can further include a step of mounting the first and second countermeasure arrangements on the platform.

Step 220 includes obtaining an output data from a detection system, at least for detecting the incoming threat.

Step 230 includes analyzing by the controlling unit at least the output data at least for tracking the incoming threat.

Step 240 includes selecting by a controlling unit a preferred countermeasure arrangement from the first and second countermeasure arrangements, at least based on the output data.

Step 250 includes instructing the preferred countermeasure arrangement to intercept the incoming threat.

According to other examples, the active protection system 100 can further include a soft kill countermeasure arrangement (e.g., a laser system) operatively connected to the controlling unit 140. This arrangement is configured for confusing the targeting mechanism of the incoming threat, and thereby causing it to miss its target, i.e., the platform. If the soft kill countermeasure arrangement fails to intersect the incoming threat, the controlling unit will instruct the preferred hard kill countermeasure arrangement to intersect the incoming threat.

According to other examples, the detection system 110 can further include other detection means such as, an electro-optical system or an IR system. In addition, the detection system 110 can further include its own controller which analyses at least a part of the output data and transfers it the controlling unit 140.

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word “comprise” or variations such as “comprises” or “comprising” is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or any other country.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A system for detecting an incoming threat, comprising:

   a. a radio frequency (RF) system configured for receiving an RF signal generated by an electromagnetic pulse associated with engine ignition of the incoming threat and providing an output data being associated with the RF signal, being used for detecting launch of the incoming threat and determining the type of the incoming threat;

   b. a radar system configured for providing an output data associated with the incoming threat, being used at least for tracking the incoming threat after the detection of its launch and the determination of its type; and

   c. a controlling unit configured for controlling the operation of the RF system and the radar system, wherein the controlling unit is configured for receiving and analyzing the output data from the RF system for detecting launch of the incoming threat and determining the type of the incoming threat at least prior to initiating the operation of the radar system.

2. The system according to Claim 1, wherein the analysis of the output data from said RF system includes application of pattern recognition techniques.

3. The system according to Claim 1, wherein the analysis of the output data from said RF system comprises performance of spectral analysis of the electromagnetic pulse.

4. The system according to Claim 3, wherein said spectral analysis includes analysis in two bands: a high band of frequencies and a low band of frequencies.

5. The system according to any one of Claims 1 to 4, wherein said RF system is further configured for tracking the incoming threat.

6. The system according to any one of Claims 1 to 5, wherein said radar system is further configured for detecting the type of the incoming threat.

7. A method for detecting an incoming threat, comprising:

   a. providing a detection system comprising: a radar system; a radio frequency (RF) system; and a controlling unit configured for controlling the operation of the RF system and the radar system;

b. receiving by said RF system an RF signal generated by an electromagnetic pulse associated with engine ignition of the incoming threat;

c. receiving from said RF system, in said controlling unit, an output data being associated with the RF signal, and being used for detecting launch of the incoming threat and determining the type of the incoming threat;

d. analyzing, by said controlling unit, said output data from the RF system for: detecting launch of the incoming threat and determining the type of the incoming threat;

e. initiating, by said controlling unit, operation of the radar system after the detection of launch of the incoming threat and determination of the type of the incoming threat;

f. receiving from said radar system, in said controlling unit, an output data being associated with the incoming threat; and

g. analyzing, by said controlling unit, said output data from the radar system for tracking the incoming threat.

8. The method according to Claim 7, wherein said step of analyzing the output data from said RF system comprises a step of applying pattern recognition techniques.

9. The method according to Claim 7, wherein the step of analyzing the output data from said RF system comprises performing spectral analysis of the electromagnetic pulse.

10. The method according to Claim 9, wherein said spectral analysis includes analysis in two bands: a high band of frequencies and a low band of frequencies.

11. The method according to any one of Claims 7 to 10, further comprising a step of analyzing, by said controlling unit, said output data from the RF system for tracking the incoming threat.

12. The method according to any one of Claims 7 to 11, further comprising a step of analyzing, by said controlling unit, said output data from the radar system for determining the type of the incoming threat.

2018203637 23 May 2018

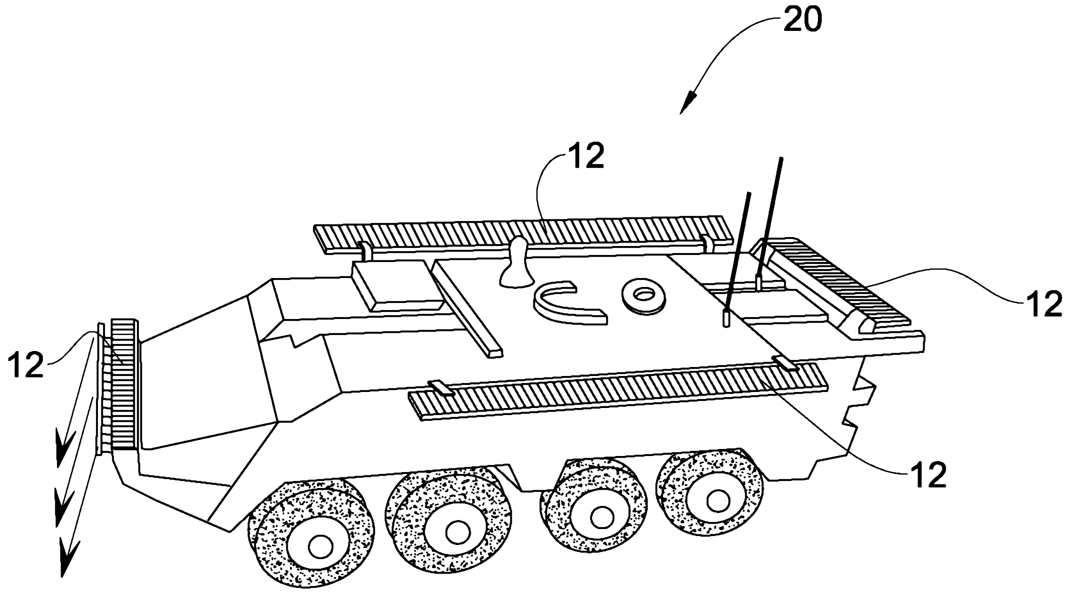

Fig. 1A

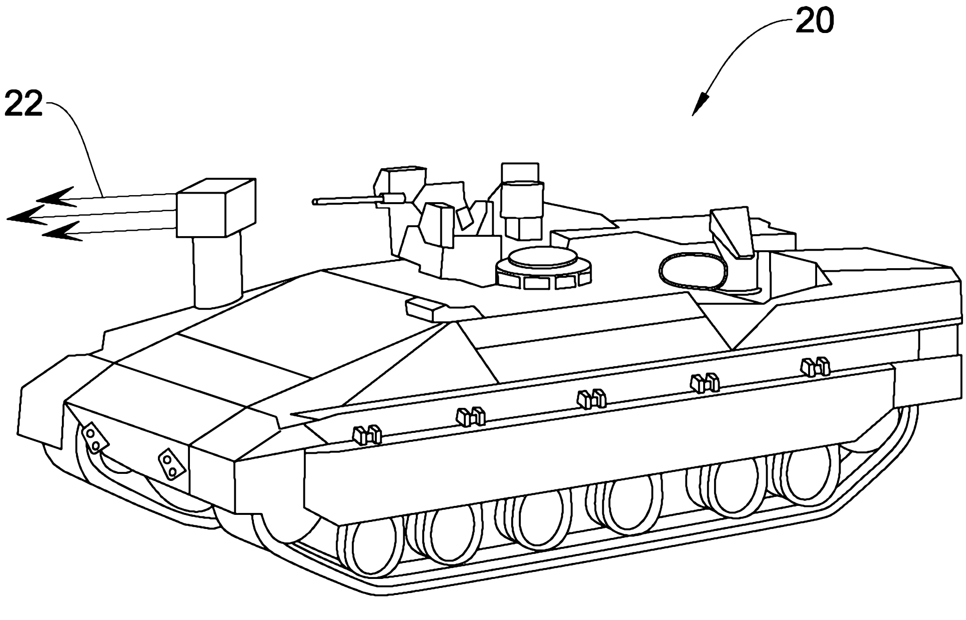

Fig. 1B (Prior Art)

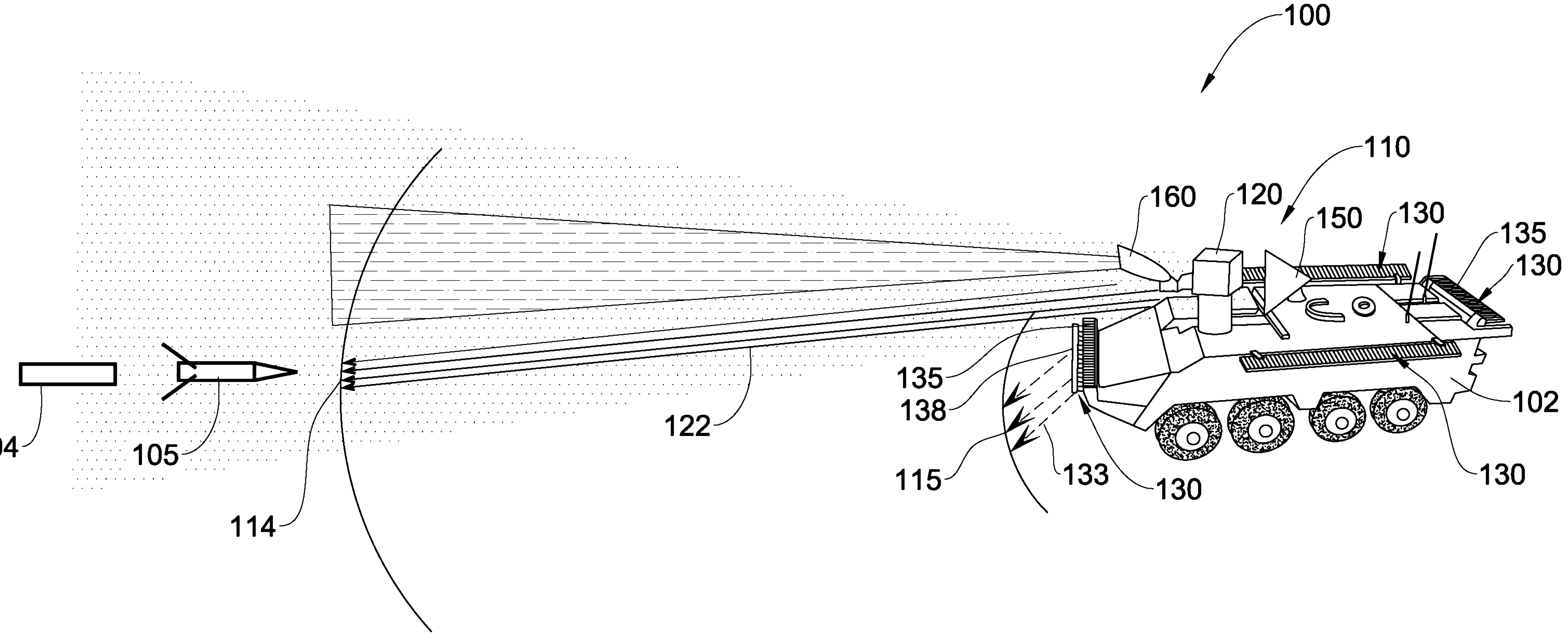
100
110
160
120
150
130
135
130
135
138
115
133
130
102
130
122
104
105
114

Fig. 2

2018203637 23 May 2018

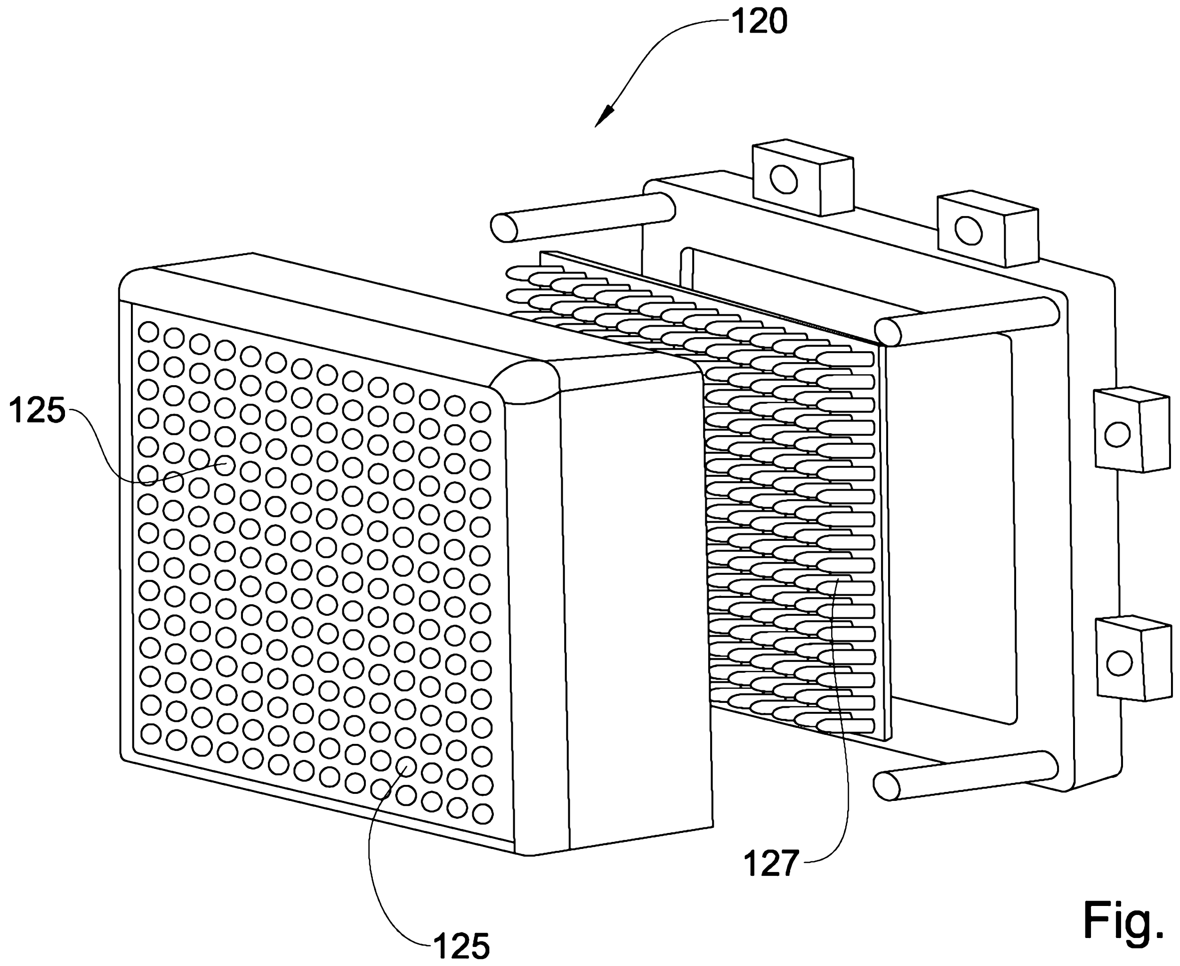

Fig. 3A

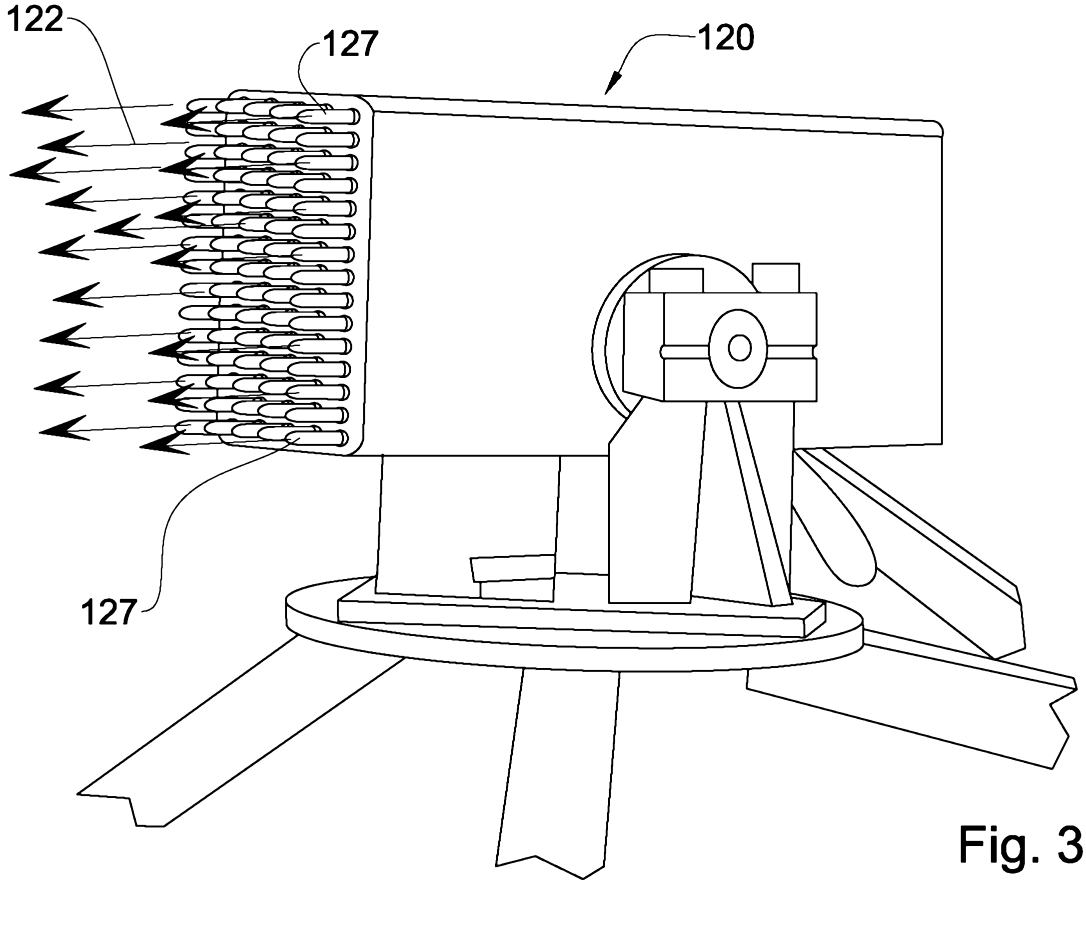

Fig. 3B

2018203637 23 May 2018

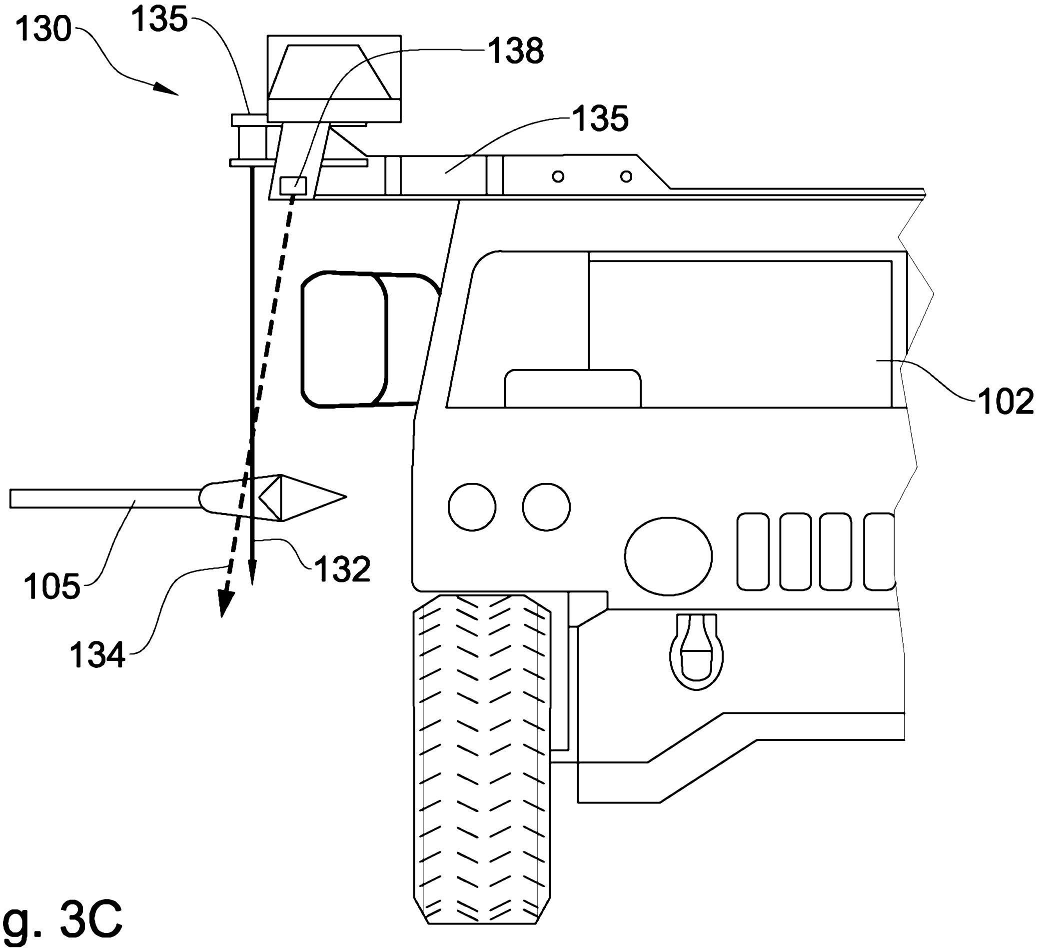

Fig. 3C

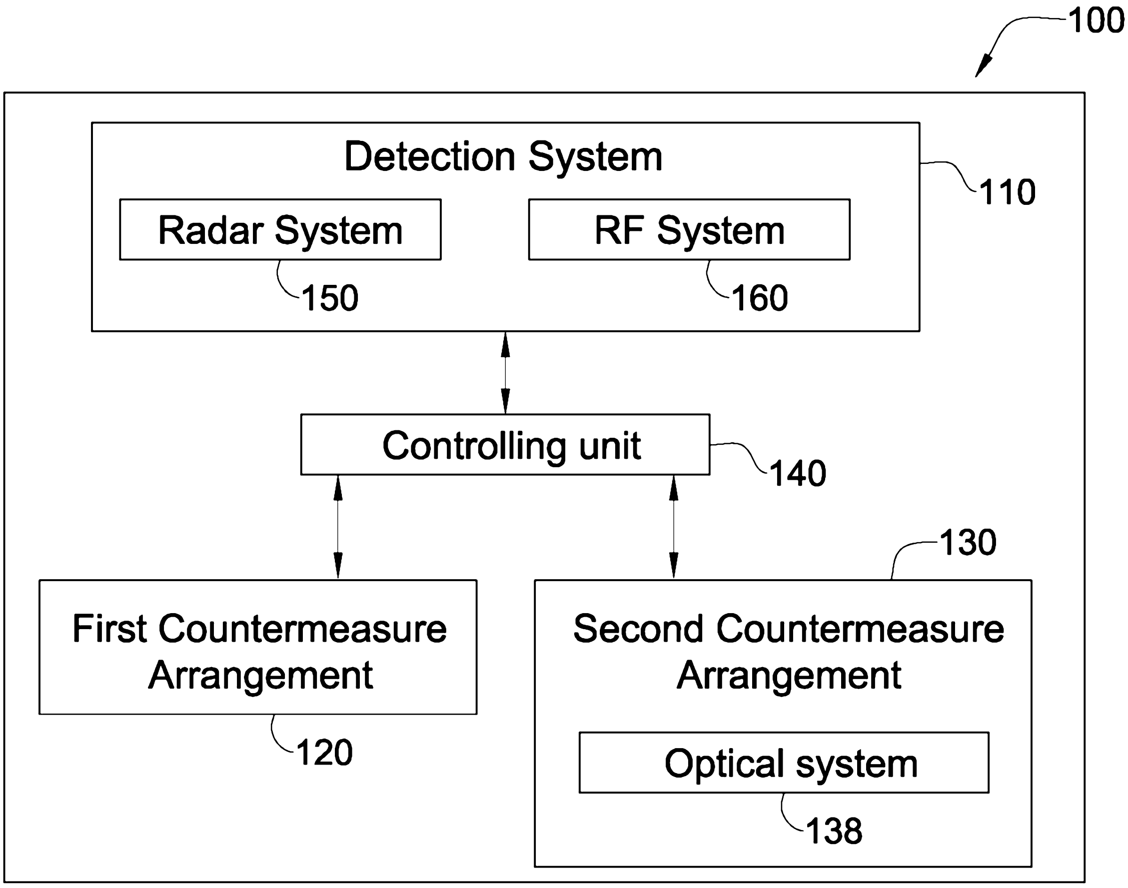

Fig. 4

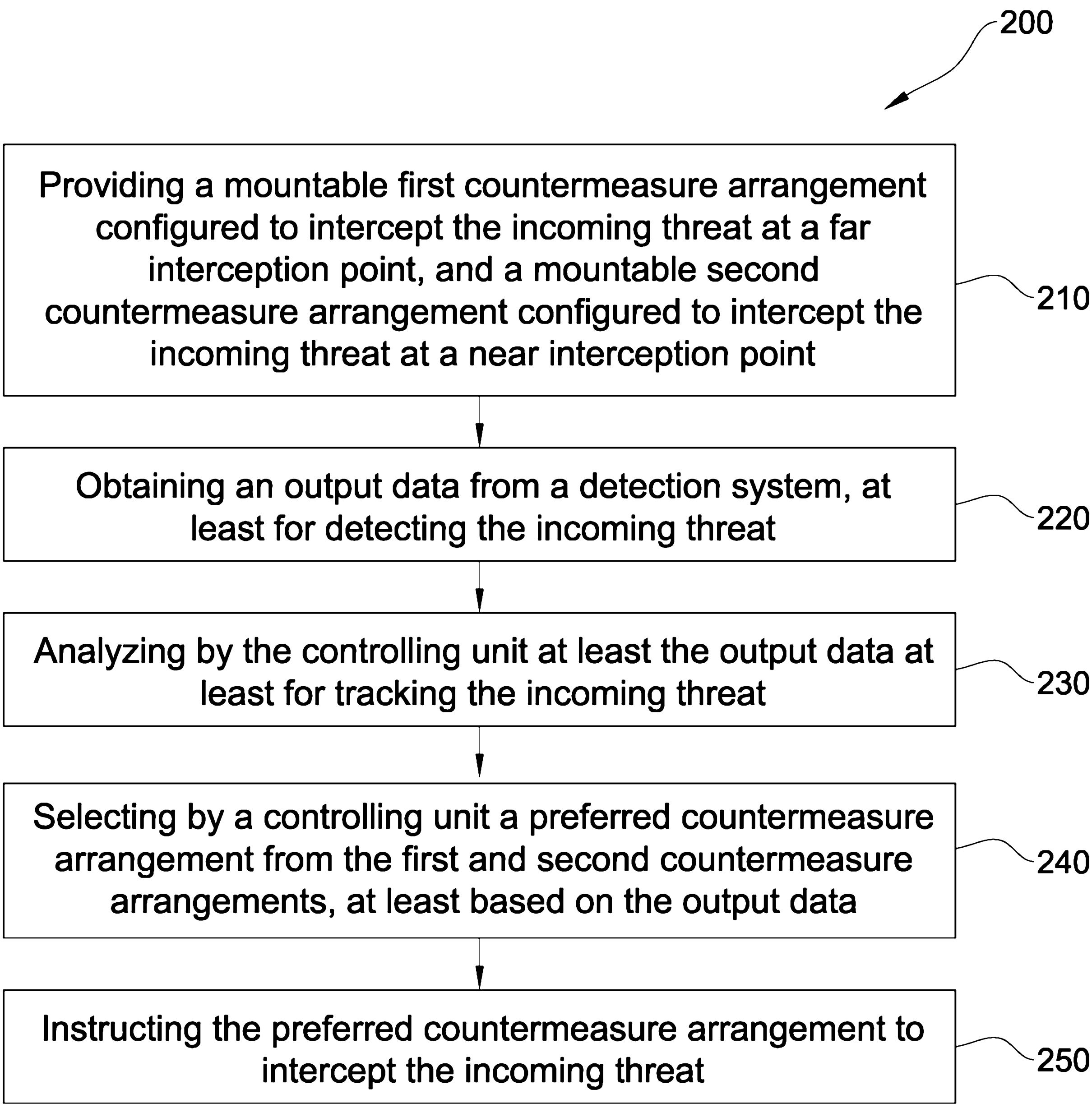
200
Providing a mountable first countermeasure arrangement configured to intercept the incoming threat at a far interception point, and a mountable second countermeasure arrangement configured to intercept the incoming threat at a near interception point
210
Obtaining an output data from a detection system, at least for detecting the incoming threat
220
Analyzing by the controlling unit at least the output data at least for tracking the incoming threat
230
Selecting by a controlling unit a preferred countermeasure arrangement from the first and second countermeasure arrangements, at least based on the output data
240
Instructing the preferred countermeasure arrangement to intercept the incoming threat
250

Fig. 5