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

(11) EP 4 495 536 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.01.2025 Bulletin 2025/04

(21) Application number: **23275108.1**

(22) Date of filing: **17.07.2023**

(51) International Patent Classification (IPC):
F42C 1/00 *(2006.01)* ***F42C 1/06*** *(2006.01)*
F42C 15/40 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F42C 1/06; F42C 1/00; F42C 15/40

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

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(54) **FUZE SYSTEM, MUNITION AND METHOD**

(57) According to the present disclosure there is provided a fuze system for a munition, the fuze system comprising an impact sensor arrangement arranged to sense a component of acceleration in an axis away from a munition travel direction in which the munition is configured to travel, the impact sensor arrangement configured to provide a first output based on the sensing of the component of acceleration in the axis away from the munition travel direction.

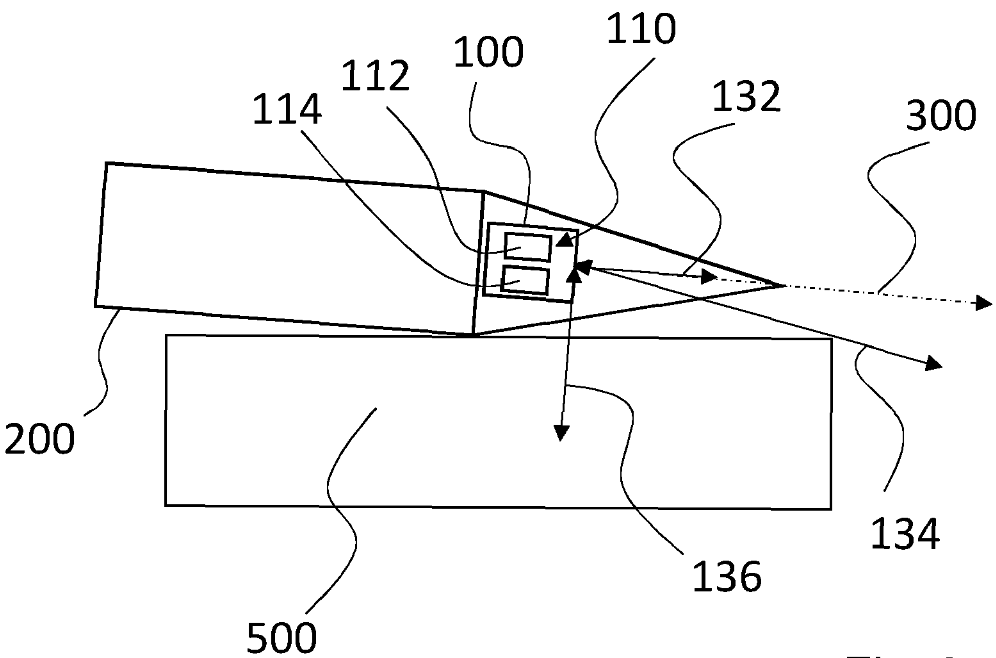

Fig. 2

Processed by Luminess, 75001 PARIS (FR)

Description

FIELD

[0001] The present invention relates generally to a fuze system, in particular to a fuze system for a munition. A related munition and method are also provided.

BACKGROUND

[0002] Munitions are provided in a number of different forms, for a number of different applications. Typically, a particular munition will be used for a particular application or intention. For the purposes of this patent application, munitions are taken to include but are not limited to artillery shells and charges, missiles, rockets, and mortar rounds.

[0003] Grazing impact occurs when there is a small relative angle between the direction of travel of the munition and the local surface of the target. Grazing impacts may occur in munitions that follow ballistic trajectories and also in direct-fire projectiles.

[0004] Conventional munition fuze systems employ a variety of mechanisms arranged to sense accelerations in the direction of travel of the munition (which may be known as "the longitudinal axis of the munition", or "an axial sense of the munition"). The sensitivity of such mechanisms must be sufficiently low to allow the munition to travel through non-target obstacles, such as rain, hail, and foliage, without triggering the explosive payload. As the acceleration magnitude in the longitudinal axis of the munition can be relatively low during grazing impacts, it is possible that conventional fuze systems may not be sufficiently sensitive to trigger the fuze. As a result, it is possible for a grazing impact to occur without triggering the payload (e.g., an explosive or non-explosive payload).

[0005] The munition may remain substantially intact and continue to travel, possibly with a change in trajectory depending on the nature of the impact. This can result in the projectile either exploding at a location that was not the intended target, or indeed not exploding at all if the forward speed has reduced such that the mechanism cannot function on subsequent impact. It will be appreciated that both scenarios can result in hazardous outcomes, such as collateral damage and unexploded ordnance (UXO) hazards. This is highly undesirable.

[0006] It is one aim of the present invention, amongst others, to provide an improved fuze system, munition and/or method, and/or address one or more of the problems discussed above, or discussed elsewhere, or to at least provide an alternative fuze system, munition and/or method

SUMMARY

[0007] According to a first aspect of the present invention, there is provided a fuze system for a munition, the fuze system comprising an impact sensor arrangement arranged to sense a component of acceleration in an axis away from a munition travel direction in which the munition is configured to travel, the impact sensor arrangement configured to provide a first output based on the sensing of the component of acceleration in the axis away from the munition travel direction.

[0008] In one example, the axis away from the munition travel direction is an axis away from (e.g., in a different direction to) the longitudinal axis of the munition. In one example, the munition travel direction is the direction in which the munition is configured to travel, e.g., when fired or during its trajectory.

[0009] In one example, the component of acceleration in an axis away from the munition travel direction is a component of acceleration in an axis transverse to the munition travel direction.

[0010] In one example, the fuze system is configured to trigger an explosive charge.

[0011] In one example, the fuze system is configured to, in response to the first output of the impact sensor arrangement being greater than or equal to a first threshold value, trigger the explosive charge.

[0012] In one example, the impact sensor arrangement is arranged to sense a component of acceleration in the axis of the munition travel direction, and the impact sensor arrangement is configured to provide a second output based on the sensing of the component of acceleration in the munition travel direction, wherein the fuze system is configured to: trigger the explosive charge in response to the second output being greater than or equal to a second threshold value.

[0013] In one example, the impact sensor arrangement is arranged to sense a component of acceleration in the munition travel direction, and the impact sensor arrangement is configured to provide a second output based on the sensing of the component of acceleration in the munition travel direction, wherein the fuze system is configured to: trigger the explosive charge in response to the second output being less than a second threshold value.

[0014] In one example, the fuze system is configured not to trigger the explosive charge in response to the first output being less than the first threshold value and the second output being less than the second threshold value.

[0015] In one example, the impact sensor arrangement comprises two orthogonally oriented sensors, or two sensing components, each arranged to sense a component of acceleration in an axis away from the munition travel direction.

[0016] In one example, the impact sensor arrangement comprises more than two sensors each arranged to sense a component of acceleration in an axis away from the munition travel direction.

[0017] In one example, the fuze system is configured to detect peaks or frequency of the output of the impact sensor arrangement.

[0018] In one example, the impact sensor arrangement comprises one or more accelerometers, capacitive accelerometers, piezoresistive accelerometers, piezoelectric sensors, magnetostrictive sensors, electromagnetic sensors, electromechanical switches, strain gauges and/or optical interference sensors.

[0019] According to a second aspect of the present invention, there is provided a munition comprising the fuze system according to the first aspect of the present invention.

[0020] The munition of the second aspect of the present invention may comprise any or all of the features of the fuze system of the first aspect of the present invention, as desired or as appropriate.

[0021] In one example, the munition is a projectile, optionally an unpropelled projectile.

[0022] In one example, the projectile comprises an artillery munition, a mortar munition, or a tank munition.

[0023] According to a third aspect of the present invention, there is provided a method of using a fuze system for a munition, the method comprising: arranging an impact sensor arrangement to sense a component of acceleration in an axis away from a munition travel direction in which the munition is configured to travel; and providing a first output from the impact sensor arrangement based on the sensing of the component of acceleration in the axis away from the munition travel direction.

[0024] In one example, the axis away from the munition travel direction is an axis away from (e.g., in a different direction to) the longitudinal axis of the munition. In one example, the munition travel direction is the direction in which the munition is configured to travel, e.g., when fired or during its trajectory.

BRIEF DESCRIPTION OF THE FIGURES

[0025] Embodiments of the invention will now be described by way of example only with reference to the figures, in which:

Figure 1 shows a munition and fuze system according to the prior art;
Figure 2 shows a munition and fuze system according to the present invention; and
Figure 3 shows a cross section of an example of the munition and fuze system of Figure 2;
Figure 4 shows a cross section of an example of the munition and fuze system of Figure 2;
Figure 5 shows a schematic of a munition; and
Figure 6 shows general methodology principles.

DETAILED DESCRIPTION

[0026] In overview, a fuze system, munition and method is described which overcomes problems faced when a munition is subject to grazing impact, which may otherwise be referred to as a "low angle impact". As discussed above, conventional fuze systems are sensitive only to a component of acceleration, or force, in the axis of the munition travel direction. During a grazing impact, the component of acceleration in the axis of the munition travel direction may be low, and thus the conventional fuze system may not be sufficiently sensitive to trigger the fuze as a result of the grazing impact, and/or may have a minimum sensitivity dictated by the need to prevent detonation prior to the munition arriving at the intended target, which prevents triggering of the fuze due to a grazing impact. The present fuze system, munition and method overcomes this problem, and also provides a number of advantages over conventional fuze systems, munitions and methods. In particular, the present fuze system comprises an impact sensor arrangement arranged to sense a component of acceleration in an axis away from a munition travel direction (i.e., sense a component of acceleration in an axis away from the direction in which the munition is configured to travel when fired). This contrasts with conventional fuze systems, which sense acceleration in the axis of the munition travel direction. By the present fuze system, grazing impacts can be detected as the fuze system is sensitive to acceleration in axis away from the munition travel direction, which is indicative of a grazing impact. It will be appreciated that acceleration referred to in the specification herein may be a deceleration of the munition. Instead of acceleration, it may alternatively be appropriate to refer to force, or force experienced by the munition.

[0027] Referring to Figure 1, a prior art fuze system 10 is shown, and will be briefly described herein. The fuze system 10 is provided in a munition 20. The munition 20 is subject to a direct impact at a target 50. A direct impact may otherwise be known as a "head-on" impact. In the illustrated example, direct impact involves an impact at an angle of approximately 90 degrees between the munition travel direction 30 and the surface 52 of the target that the munition 20 is to impact. During the direct impact at the target 50, high acceleration is experienced in the axis of the munition travel direction 30. The axis of the munition travel direction 30 is indicated generally at numeral 32. It will be appreciated that the axis 32 of the munition travel direction 30 may be colinear with the munition travel direction 30. The fuze system 10 is arranged to sense acceleration in the axis 32 of the munition travel direction 30, which may otherwise be known as a longitudinal axis of the munition 20, or in the munition axial sense. In this way, when the direct impact is sensed, the fuze is triggered.

[0028] Angled impacts may also occur. An angled impact may involve an impact at an angle within a range of less than 90 degrees to approximately 10 degrees. In this event, the acceleration may be separated into a component of acceleration in the axis of the munition travel direction 30 and a component of acceleration in an axis transverse to the munition travel direction 30. The combined magnitude of acceleration may be relatively high. Nevertheless, in prior art fuze systems 10 subjected to angled impacts, the fuze of the fuze system 10 will only be triggered if the acceleration in the axis 32 of the munition travel direction 30 exceeds the necessary threshold for triggering the fuze.

[0029] The prior art munition 20 may be subject to a grazing impact at the target 50. In such an event, the acceleration forces experienced in the axis 32 of the munition travel direction 30 may be low, or comparably low relative to the expected acceleration in the axis 32 of the munition travel direction 30 due to direct impact or angled impact. This sensed acceleration may be insufficient to trigger the fuze of the fuze system 10. The munition may rebound whilst remaining intact, and continue to travel without detonating. Post-impact trajectory is less predictable, and the munition may travel to an unintended location. Furthermore, as the fuze system 10 is only arranged to sense acceleration in the axis 32 of the munition travel direction 30, the fuze system 10 is unable to distinguish a direct impact event from a grazing impact event or angled impact event.

[0030] Referring to Figure 2, a fuze system 100 according to an embodiment of the present invention is shown. The fuze system 100 is for a munition 200.

[0031] The fuze system 100 comprises an impact sensor arrangement 110. The impact sensor arrangement 110 is arranged to sense a component of acceleration in an axis away from the munition travel direction 300. The axis away from the munition travel direction 300 is indicated generally at numeral 134. It will be appreciated that the axis 134 away from the munition travel direction 300 is not colinear with the munition travel direction 300, but is angled away from the munition travel direction 300. It will be appreciated that the munition travel direction 300 is the direction in which the munition 200 is configured to travel when it is fired, when it is travelling, or during its trajectory. The munition travel direction 300 may be the intended, or expected, munition travel direction. The person skilled in the art will appreciate that the munition travel direction 300 may be (and indeed, preferably is) a longitudinal axis of the munition 200. That is, the munition 200 may be configured (i.e., deliberately configured or designed) to travel in a munition travel direction 300, and the impact sensor arrangement 110 arranged to sense a component of acceleration in an axis 134 away from said munition travel direction 300.

[0032] In this way, by the impact sensor arrangement 110 being arranged to sense a component of acceleration in an axis 134 away from the munition travel direction 300, an improved fuze system 100 is provided which is sensitive to non-direct impacts (that is, impacts which occur at angles away from direct impact). An example of a non-direct impact is shown in Figure 2, where the munition 200 is subject to a grazing impact at a target 500, but it will be appreciated that other angled impacts may be detected using the fuze system 100. Furthermore, the fuze system 100 can distinguish between grazing impact and low velocity direct impact. Thresholds for triggering the fuze of the fuze system 100 can be set accordingly, enabling safer and more robust operation of the fuze system 100 and munition 200.

[0033] The impact sensor arrangement 110 is configured to provide a first output based on the sensing of the component of acceleration in the axis 134 away from the munition travel direction 300. As above, the axis 134 away from the munition travel direction 300 may be the axis 134 away from the intended munition travel direction 300, and/or the axis 134 away from the longitudinal axis of the munition 200.

[0034] In this way, the first output may be used by the fuze system 100 to trigger the fuze, thereby to trigger the explosive payload.

[0035] The component of acceleration in the axis 134 away from the munition travel direction 300 may be a component of acceleration in an axis transverse to the munition travel direction 300. For avoidance of doubt, an axis transverse to the munition travel direction 300 is an example of an axis away from the munition travel direction 300. That is, the impact sensor arrangement 110 may be arranged, or configured, to sense the component of acceleration in an axis transverse to the munition travel direction 300, or longitudinal axis of the munition 200. The axis transverse to the munition travel direction 300 is indicated generally at 136. In this advantageous embodiment, the impact sensor arrangement 110 (i.e., sensors and/or components thereof) are arranged to sense acceleration along, or in, the transverse axis 136.

[0036] This is a highly advantageous arrangement. In contrast to prior art fuze systems which are only arranged to sense the component of acceleration in the axis of the munition travel direction, by sensing the component of acceleration in an axis 136 transverse to the munition travel direction 300, a grazing impact can be detected or sensed. This is because during a grazing impact event, the component of acceleration in an axis 136 transverse to the munition travel direction 300 is relatively high compared with the component of acceleration in an axis of the munition travel direction 300.

[0037] The fuze system 100 may be configured to trigger an explosive charge 400. The fuze system 100 may be configured to trigger the explosive charge 400 based on the first output.

[0038] In this way, safety is improved as the explosive charge may be triggered when a non-direct impact is detected or sensed.

[0039] The fuze system 100 may be configured to trigger the explosive charge 400 in response to the first output of the impact sensor arrangement 110 being greater than or equal to a first threshold value.

[0040] In this way, when the sensed component of acceleration in the axis 134 away from the munition travel direction is greater than or equal to a first threshold value, the explosive charge is triggered, which may occur due to a grazing impact with a target.

[0041] The impact sensor arrangement 110 may be further arranged to sense a component of acceleration in the axis of the munition travel direction 300. The axis of the munition travel direction 300 is indicated generally at numeral 132. It will be appreciated that the axis 132 of the munition travel direction 300 may be colinear with the munition travel direction 300. That is, the impact sensor arrangement 110 may comprise the functionality of the prior art, in addition to that of the present invention wherein the impact sensor arrangement is arranged to sense a component of acceleration in an axis 134 away from the munition travel direction 300.

[0042] In respect of this, the impact sensor arrangement 110 may comprise a first-type impact sensor 112 (which may be taken to include, or be, a subarrangement of first-type impact sensors, e.g., comprising one or more first-type impact sensors) arranged to sense a component of acceleration in an axis 134 away from a munition travel direction 300. The impact sensor arrangement 110 may further comprise a second-type impact sensor 114 (which may be taken to include, or be, a subarrangement of second-type impact sensors, e.g., comprising one or more second-type impact sensors) arranged to sense a component of acceleration in the axis 132 of the munition travel direction 300.

[0043] It will be appreciated from the above that the fuze system 100 may only be provided with an impact sensor arrangement 110 arranged to sense a component of acceleration in an axis away from a munition travel direction 300. As above, this is advantageous in sensing, and appropriate functioning in response to, grazing impacts. However, by the impact sensor arrangement 110 being additionally arranged to sense the component of acceleration in the munition travel direction 300, further advantages are provided. In particular, it may be easier to distinguish between grazing impacts, angled impacts, direct impacts, and also non-target impacts.

[0044] The impact sensor arrangement 110 may be configured to provide a second output based on the sensing of the component of acceleration in axis of the munition travel direction 300. The second output may be provided by the second-type impact sensor 114.

[0045] The fuze system 100 may be configured to trigger the explosive charge in response to the second output (i.e., provided by the second-type impact sensor 114) being greater than or equal to a second threshold value and the first output (i.e., provided by the first-type impact sensor 112) being greater than or equal to a first threshold value.

[0046] In this way, the fuze system 100 may thus appropriately trigger the explosive charge in response to a direct or angled impact, resulting in improved safety of the fuze system 100 and munition 200. Furthermore, where a grazing impact occurs or is expected to occur, the threshold value for the second output could be set to be relatively low, as long as the threshold value for the first output is set to be relatively high.

[0047] In another example in which the impact sensor arrangement 110 is configured to provide a second output based on the sensing of the component of acceleration in the axis of the munition travel direction 300, the fuze system 100 may be configured to trigger the explosive charge in response to the second output being less than a second threshold value and the first output of the impact sensor arrangement 110 being greater than or equal to a first threshold value.

[0048] In this way, a grazing impact may be determined, and the explosive charge appropriately triggered.

[0049] The fuze system 100 may be configured not to trigger the explosive charge in response to the first output being less than the first threshold value and the second output being less than the second threshold value.

[0050] In this way, safety is improved as it is established that both the component of acceleration in the axis of the munition travel direction and the component of acceleration in the axis away from the munition travel direction is insufficient to indicate that an impact event of any kind with a target-of-interest has taken place. This may prevent any kind of impact with rain, hail, foliage, or the like from triggering the explosive charge.

[0051] In another example in which the impact sensor arrangement 110 is configured to provide a second output based on the sensing of the component of acceleration in the axis 132 of the munition travel direction 300, the fuze system 100 may be configured to trigger the explosive charge in response to the second output being greater than or equal to a second threshold value and the first output of the impact sensor arrangement 110 being less than or equal to a first threshold value.

[0052] In this way, a direct impact event can trigger the explosive charge.

[0053] Where threshold values are referred to above, the first threshold values may be the same first threshold values and the second threshold values may be the same second threshold values. The first threshold values and second threshold values may be different. Appropriate threshold values may be selected, used or set for the particular use case.

[0054] As describe above, the fuze system 100 is configured to compare outputs from the impact sensor arrangement 110 with threshold values. In respect of this, the fuze system 100 may comprise a processor (not shown) to perform the comparison. The fuze system 100 may further comprise a memory (not shown) configured to store threshold values. The processor may compare the output of the impact sensor arrangement 110 with the threshold value stored in the memory. The processor may provide a signal to a fuze of the fuze system 100 to trigger the explosive charge.

[0055] Referring to Figure 3, an exemplary construction of the munition 200 is shown in a front cross-section, viewed along the axis 132 of the munition travel direction 300 (e.g., along the longitudinal axis of the munition 200). In the example illustrated, the impact sensor arrangement 110 comprises two sensors 112a, 112b which are orthogonally oriented with respect to one another. The two sensors 112a, 112b may be provided by two sensing components, which may be two components of the same sensor. The two sensors 112a, 112b may form part of the first-type impact sensor 112.

[0056] Each sensor 112a, 112b may be arranged to sense a component of acceleration in an axis 134 away from the munition travel direction 300. In this example shown, each sensor 112a, 112b is arranged to sense a component of acceleration in an axis 136a, 136b transverse to the munition travel direction 300. Each sensor 112a, 112b may be arranged to sense an orthogonal component of acceleration.

[0057] Such a construction is highly advantageous in a munition which is configured to spin (or rotate) during its trajectory. Such munitions may be known as spin-stabilised munitions. In such cases, the sign and magnitude of the component of acceleration in the axis 136a, 136b away from the munition travel direction 300 may be affected by the relative orientation between the sensing axis 136a, 136b of the impact sensor arrangement 110, the degree of rotation and the point and duration of impact. That is, in an example where the impact sensor arrangement 110 is arranged to sense a component of acceleration in an axis 136a, 136b transverse to the munition travel direction 300, if a grazing impact occurs when the sensing axis is perpendicular to the transverse impact axis with the surface of the target, the impact sensor arrangement 110 would not sense the grazing impact. In this way, null zones may result, and grazing impact may not be detectable. This may occur twice per rotation of the munition 200. By providing two orthogonally oriented sensors 112a, 112b, this problem is addressed, as at least one of the sensors 112a, 112b would always sense the component of acceleration. Providing two sensors 112a, 112b may also be advantageous in redundancy, thereby to ensure safe operation of the munition 200. It is further possible to calculate the magnitude of the acceleration due to grazing impact by adding the acceleration vectors determined from the output of the two sensors 112a, 112b.

[0058] It will be appreciated by the skilled person that in spin-stabilised munitions, the impact of centrifugal acceleration on the response of the impact sensor arrangement 110 may need to be considered, for example by setting appropriate thresholds such that centrifugal acceleration alone is insufficient to trigger the fuze of the fuze system 100.

[0059] Referring to Figure 4, an exemplary construction of the munition 200 is shown in a front cross-section, viewed along the axis 132 of the munition travel direction 300 (e.g., along the longitudinal axis of the munition 200). In the example illustrated, the impact sensor arrangement 110 comprises more than two sensors. In the illustrated example, the impact sensor arrangement 110 comprises three sensors 112c, 112d, 112e. The sensors 112c, 112d, 112e may be provided by a corresponding number of sensing components, which may be components of the same sensor. The more than two sensors 112c, 112d, 112e may form part of the first-type impact sensor 112. The sensors 112c, 112d, 112e may be radially arranged, for example spaced by 360/n degrees, where n is the number of sensors 112c - 112e. Advantageously, providing more than two sensors may facilitate use of sensor types with more limited capabilities, for example non-ratiometric and/or non-directional sensors. The combined output from these sensors may then be used to derive a measurement of the component of acceleration in the axis away from the munition travel direction 300 (e.g., the transverse acceleration).

[0060] In a further example of the fuze system 100, a single first-type impact sensor 112 arranged to sense a component of acceleration in an axis 134 away from a munition travel direction 300 may be sampled over a relatively long period, which may be at least one rotation period, and peak detection used to determine an impact event. Advantageously, in this way, the impact of the null zones may be reduced. Furthermore, this may reduce the need for multiple sensors in the impact sensor arrangement 110.

[0061] In a further example of the fuze system 100, the frequency component of a single sensor 112 arranged to sense a component of acceleration in an axis 134 away from a munition travel direction 300 could also be exploited, and the typical rotation rate range of the munition could be used to improve discrimination of impact type. Furthermore, this may reduce the need for multiple sensors in the impact sensor arrangement 110.

[0062] The sensing of the impact sensor arrangement 110 may be used to determine a ratio of the components of acceleration. This may be dependent on the location and orientation of sensors, nature of sensor outputs, number of sensors, and other factors. In an example, the output of a first-type impact sensor 112 and the output of a second-type impact sensor 114 can be used to determine a ratio of the components of acceleration. The first-type impact sensor 112 and second-type impact sensor 114 may be orthogonally arranged. The magnitudes of the ratiometric outputs of both sensors may be on the same relative scale. Trigonometric calculation can be used to define ratios for particular angles of impact, according to the equation *tan(impact angle) = output of the second type impact sensor 114 / output of the first type impact sensor* 112. In such an example, if a further orthogonal sensor (e.g., a third impact sensor) is incorporated, the three outputs can be resolved into a single instantaneous acceleration vector, using a similar trigonometric calculation. Applicable here, and throughout the disclosure, taking into account the ratio of acceleration components rather than absolute magnitudes thereof may be advantageous as impact events may occur over a wide range of velocities.

[0063] It is possible for the impact sensor arrangement 110 to make use of many different types of impact sensors. Different types of impact sensors, and their operation, suitability and functionality, will be well understood by those skilled in the art. The impact sensor arrangement 110 may comprise one or more accelerometers, which may be capacitive accelerometers and/or piezoresistive accelerometers. The impact sensor arrangement 110 may additionally or alternatively comprise one or more piezoelectric sensors, magnetostrictive sensors, electromagnetic sensors, electromechanical switches, strain gauges and/or optical interference sensors.

[0064] Referring to Figure 5, a munition 200 is schematically illustrated. The munition 200 comprises a fuze system 100 in accordance with that described herein. That is, the fuze system 100 may comprise any or all of the features described herein.

[0065] The munition may be a projectile. The projectile may be an unpropelled projectile. The projectile may comprise an artillery munition, a mortar munition, or a tank munition.

[0066] Referring to Figure 6, a method is schematically shown. The method is a method of using a fuze system for a munition. Step S610 comprises arranging an impact sensor arrangement to sense a component of acceleration in an axis away from a munition travel direction in which the munition is configured to travel. Step S620 comprises providing a first output from the impact sensor arrangement based on the sensing of the component of acceleration in the axis away from the munition travel direction.

Claims

1. A fuze system for a munition, the fuze system comprising an impact sensor arrangement arranged to sense a component of acceleration in an axis away from a munition travel direction in which the munition is configured to travel, the impact sensor arrangement configured to provide a first output based on the sensing of the component of acceleration in the axis away from the munition travel direction.

2. The fuze system according to claim 1, wherein the component of acceleration in an axis away from the munition travel direction is a component of acceleration in an axis transverse to the munition travel direction.

3. The fuze system according to claim 1 or claim 2, wherein the fuze system is configured to trigger an explosive charge.

4. The fuze system according to claim 3, wherein the fuze system is configured to, in response to the first output of the impact sensor arrangement being greater than or equal to a first threshold value, trigger the explosive charge.

5. The fuze system according to claim 4, wherein the impact sensor arrangement is arranged to sense a component of acceleration in the axis of the munition travel direction, and the impact sensor arrangement is configured to provide a second output based on the sensing of the component of acceleration in the munition travel direction, wherein the fuze system is configured to:
trigger the explosive charge in response to the second output being greater than or equal to a second threshold value.

6. The fuze system according to claim 4, wherein the impact sensor arrangement is arranged to sense a component of acceleration in the munition travel direction, and the impact sensor arrangement is configured to provide a second output based on the sensing of the component of acceleration in the munition travel direction, wherein the fuze system is configured to:
trigger the explosive charge in response to the second output being less than a second threshold value.

7. The fuze system according to claim 5 or claim 6, wherein the fuze system is configured not to trigger the explosive charge in response to the first output being less than the first threshold value and the second output being less than the second threshold value.

8. The fuze system according to any one of the preceding claims, wherein the impact sensor arrangement comprises two orthogonally oriented sensors, or two sensing components, each arranged to sense a component of acceleration in an axis away from the munition travel direction.

9. The fuze system according to any one of the preceding claims, wherein the impact sensor arrangement comprises more than two sensors each arranged to sense a component of acceleration in an axis away from the munition travel direction.

10. The fuze system according to any one of the preceding claims, wherein the fuze system is configured to detect peaks or frequency of the output of the impact sensor arrangement.

11. The fuze system according to any one of the preceding claims, wherein the impact sensor arrangement comprises one or more accelerometers, capacitive accelerometers, piezoresistive accelerometers, piezoelectric sensors, magnetostrictive sensors, electromagnetic sensors, electromechanical switches, strain gauges and/or optical interference sensors.

12. A munition comprising the fuze system according to any one of the preceding claims.

13. The munition of claim 12, wherein the munition is a projectile, optionally an unpropelled projectile.

14. The munition of claim 13, wherein the projectile

comprises an artillery munition, a mortar munition, or a tank munition.

15. A method of using a fuze system for a munition, the method comprising:

arranging an impact sensor arrangement to sense a component of acceleration in an axis away from a munition travel direction in which the munition is configured to travel; and
providing a first output from the impact sensor arrangement based on the sensing of the component of acceleration in the axis away from the munition travel direction.

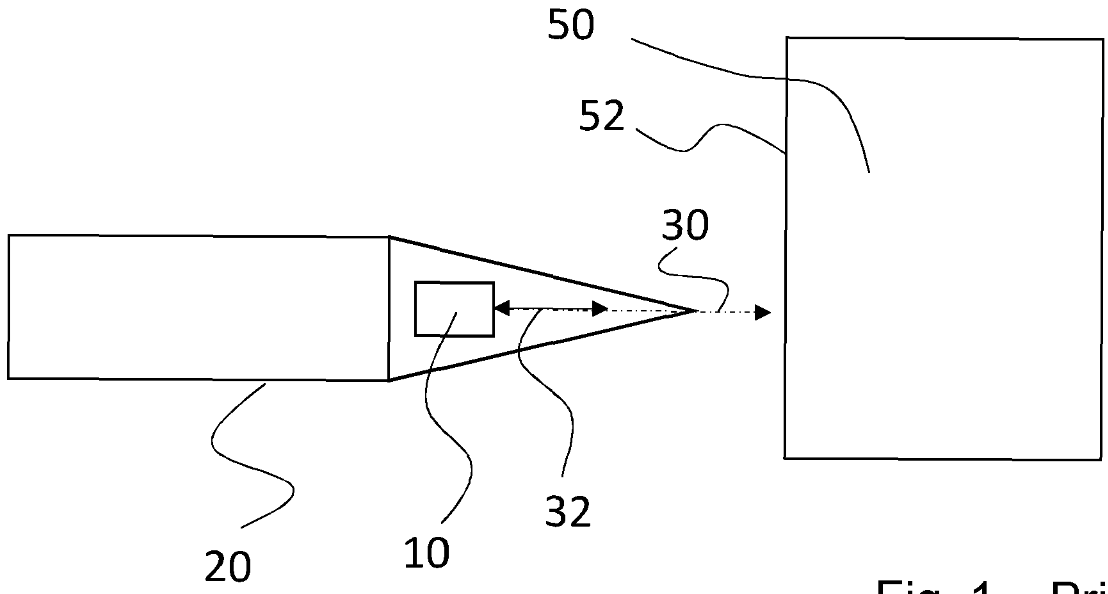

Fig. 1 – Prior art

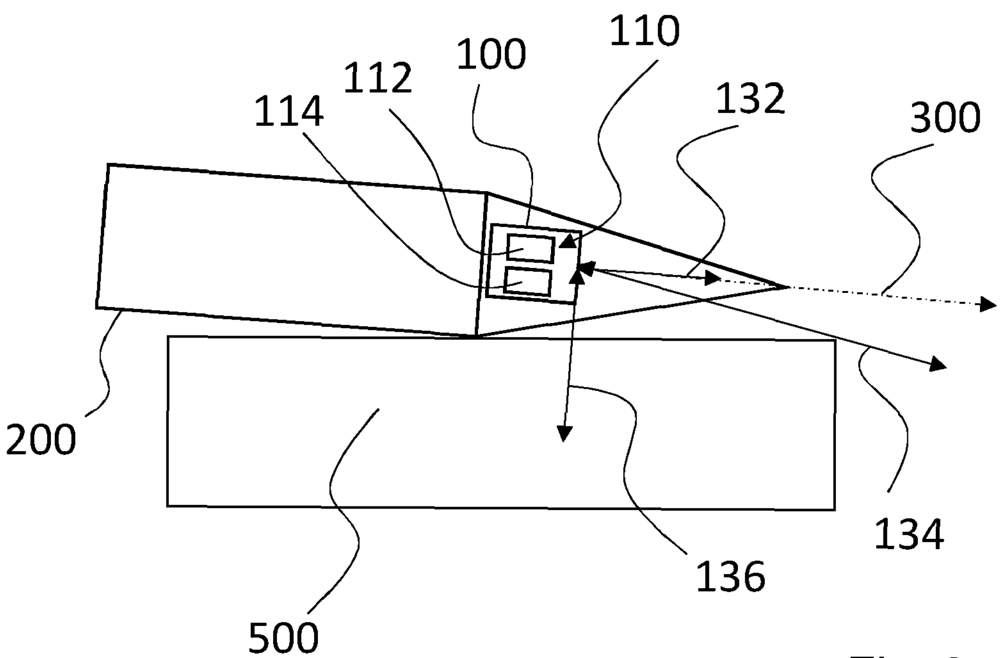

Fig. 2

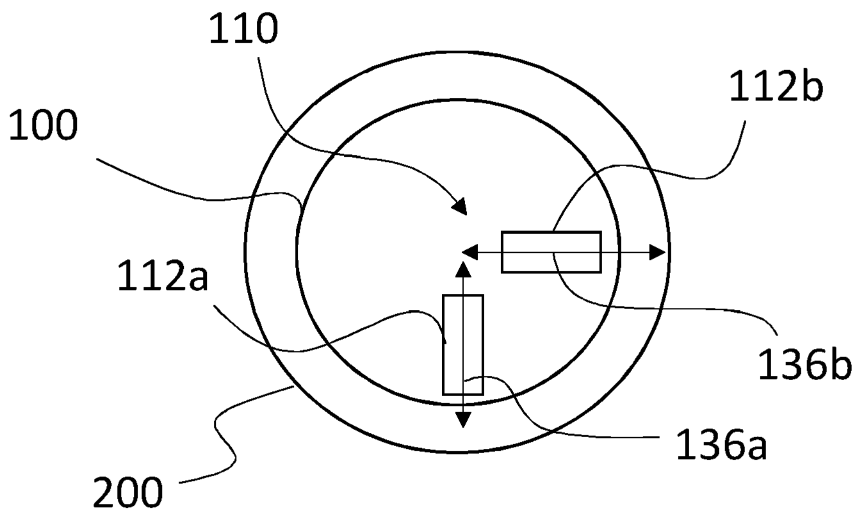
110
112b
100
112a
136b
136a
200

Fig. 3

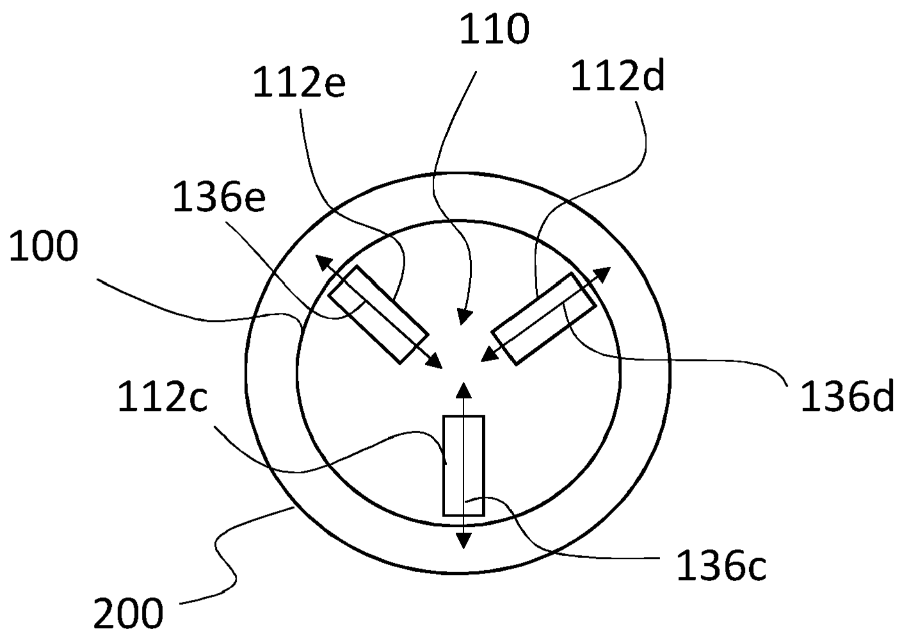
110
112e
112d
136e
100
136d
112c
136c
200

Fig. 4

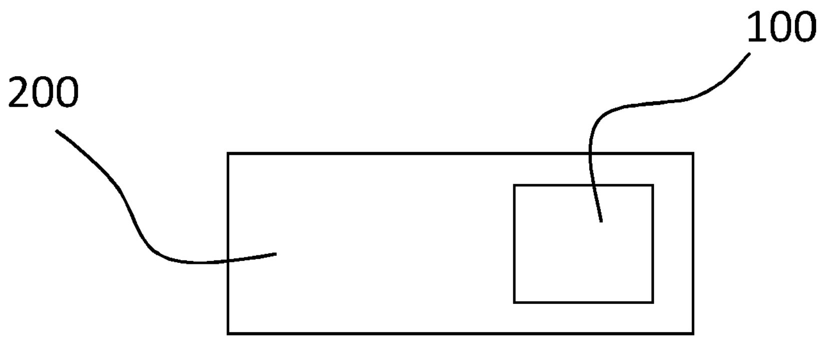
100
200

Fig. 5

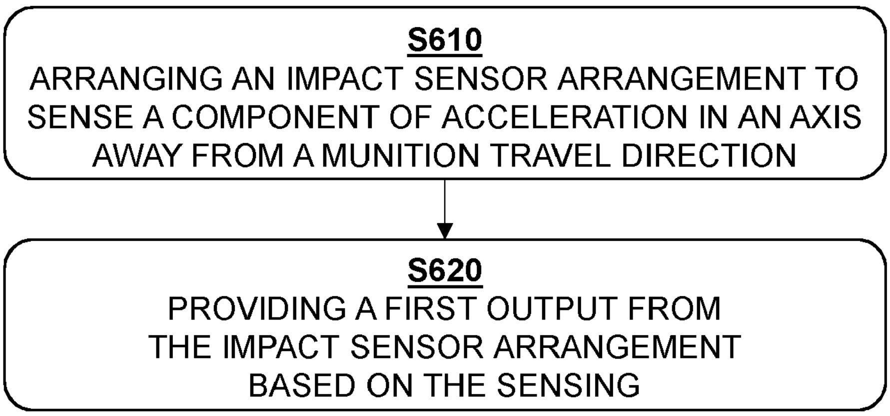
S610
ARRANGING AN IMPACT SENSOR ARRANGEMENT TO SENSE A COMPONENT OF ACCELERATION IN AN AXIS AWAY FROM A MUNITION TRAVEL DIRECTION
S620
PROVIDING A FIRST OUTPUT FROM THE IMPACT SENSOR ARRANGEMENT BASED ON THE SENSING

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 23 27 5108

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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
The Hague	15 December 2023	Menier, Renan

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