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Positioning device for scatterable sub-munition

The scope of the present invention is that of positioning devices for scatterable sub-munitions and in particular for bi-directif plate charge mines.

When the mines are spread over the ground by means of a cargo shell or a mine scatterer, the problem of positioning them on the ground arises.

We know by addendum certificate FR247516 a bi-directif plate charge mine.

Such a mine is efficient whichever face it reaches the ground on. Flexible tabs distributed around its periphery avoid the mine from being immobilized on its edge by rolling it to a stable position on one of its faces.

However, if these flexible tabs enable the problem of orientation to be solved on hard ground, they are totally inoperative on soft ground where the mines sink in regardless of their position which makes them ineffective.

Patent US3205322 describes an anti-personnel which may be scattered by aircraft. This mine is fitted with flexible tabs on its rear part. These tabs open up as the mine is falling which enables the behaviour of the latter to be stabilised with its forward end directed towards the ground. Such a device enables the sub-munition to be favourably orientated with respect to the ground but does not improve its capacity to land on hard ground, in which case the mine lands laterally and becomes ineffective.

The purpose of the present invention is to propose a positioning device for scatterable mines and notably for bi-directif plate charge mines, a device which ensures the correct positioning of the mines both on hard and soft ground.

The object of the invention is therefore a positioning device for a sub-munition, of the bi-directif scatterable type, and comprises a set of flexible tabs distributed at regular intervals around the sub-munition, a device characterised in that the distribution of the tabs is such that the resultant of the aerodynamic resistance to which

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REPLACED SHEETS SG

☒ Description : paged1..... to paged12.....
☒ Claim(s) : paged13..... to paged14.....
☒ Drawing(s) : paged119..... to paged919.....
☒ Abstract : pagedlast page..... to paged-.....

01714050965 2

the sub-munition is subjected has its aerodynamic centre behind the latter's centre of gravity, and in that the tabs integral with one face located on a rear part of the sub-munition in the direction in which it follows its trajectory have such a shape that they are subjected to a permanent deformation during the scattering of the mine.

In one particular embodiment of the invention, the positioning device is designed to equip a sub-munition scattered by a vehicle which has a rotational movement, such as an artillery cargo shell, it is characterised in that the tabs are subjected to a permanent deformation under the effect of the centrifugal force.

Advantageously, the distribution of the tabs is such that they are all integral with a face situated on a rear part of the sub-munition in the direction in which it follows its trajectory.

According to one variant, the distribution of the tabs is such that the aerodynamic resistance which results from the tabs which are integral with a face situated on the rear part of the sub-munition in the direction in which it follows its trajectory is greater than that of the tabs which are integral with a face opposite to the rear face.

In particular, the number of tabs which are integral with a forward face may be equal to that of the tabs integral with the rear face and the surface area of the tabs integral with the rear face may be greater than that of the tabs integral with the forward face.

In one particular embodiment of the invention, the tabs integral with the forward face are made of bent wires.

In a preferential embodiment, in their deployed position the tabs integral with the rear face of the sub-munition make an angle with the axis of the sub-munition such that the diameter of a circle in which their free ends are distributed is greater than twice the height of the sub-munition.

In a preferred embodiment, the deformable tabs could

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be fitted with a longitudinal opening whose width steadily increases from the base of the tab to its free end.

The invention will be better understood after reading the description which will follow of particular
5 embodiments of the invention, a description which refers to the drawings given in annexe and in which :

- figure 1 represents a part cross sectional drawing of a bi-directif mine fitted with a positioning device according to prior art,

10 - figure 2 represents a part cross sectional drawing of a bi-directif mine fitted with a positioning device according to a first embodiment of the invention,

- figure 3 is a view of the mine in figure 2 following direction X,

15 - figure 4 represents a part cross sectional drawing of a bi-directif mine fitted with a positioning device according to a second embodiment of the invention,

- figure 5 is a detailed view of one of the tabs integral with the forward face of the mine according to
20 figure 4,

- figures 6 and 7 represent a bi-directif mine fitted with a positioning device according to a third embodiment of the invention,

25 - figures 8a and 8b represent a single tab figure 8b being a cross section of the tab following the plane for which the direction AA is indicated on figure 8a.

- figure 8c shows the bi-directif mine which features in figures 6 and 7 after the permanent deformation of the tabs,

30 - figure 9 shows in diagram form the landing of a mine fitted with a device according to the invention onto soft ground,

- figures 10a and 10b shows in diagram form the landing of a mine fitted with a device according to the
35 invention onto hard ground.

If we refer to figure 1, a sub-munition 1 of the scatterable mine type, according to prior art as



represented by addendum certificate FR2475716, comprising a casing box 2 containing an explosive charge 3. The latter is fitted, in a known way and described by FR2475716, with two liners (the liners of this charge are not represented).

The casing box 2 is embedded in a shock absorbing structure 4 in plastic material. Two metallic washers 5 and 6 are positioned on the round notches 7 and 8 cut into the faces 9 and 10 respectively.

The washers are made integral with the mine by means of tension rods 11, distributed at an angle at regular intervals, and which go through the mine. The ends of the tension rods are rivetted onto the washers 5 and 6.

The mine also includes flexible tabs 12 distributed at regular intervals around its circumference. One end of these tabs is integral with one face of the mine level with rivets 13a, 13b of the tension rods 11 on the washers 5 or 6.

The other end of the tabs is free and is situated roughly in a mid-plane 14 of the mine.

A certain number of tabs is fastened to face 10, an equal number of tabs is fastened to face 9.

The tabs integral to one face are alternately distributed at an angle with tabs integral to the other face.

The tabs 12 can fold back into housings 15 cut into the shock absorbing structure 4. They are bent back in this way when the mine is put inside a shell or a launcher tube. They are deployed when the mine is ejected from the shell or the launcher tube.

As stated in the foreword, elastic tabs enable the problem of the orientation of a mine on hard ground to be solved, but they are totally inoperative on soft ground where the mines sink in regardless of their position which makes them ineffective.

Figure 2 represents a sub-munition 1, of a bi-directif

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01714050965 5

plate charge type, which is fitted with a positioning device according to a first embodiment of the invention.

5 This mine 1 also includes two metallic washers 5 and 6 which are positioned on round noches 7 and 8 fitted into faces 9 and 10 respectively.

The washers are made integral with the mine by means of tension rods 11, distributed at right angles at regular intervals, and which go through the mine. The ends of the tension rods are rivetted onto the washers 5 and 6.

10 Mine 1 includes here sixteen tabs 16 distributed at regular intervals at an angle and of which one end is integral with face 10 of the mine level with rivets 13b of the tension rods 11 on the washer 6.

No tabs have been fitted to face 9 of the mine.

15 Face 10 of the mine is that which is situated at the rear of the mine in the direction in which it follows its trajectory after being ejected from a shell or from a launcher tube.

20 This particular distribution of the tabs ensures that the resultant of the aerodynamic resistance to which the mine is subjected during its ballistic trajectory will have its aerodynamic centre to the rear of the centre of gravity of the mine (this point may be roughly located at the intersection of a mid-plane 14 and the axis 19 of the mine).

25 This arrangement stabilizes the mine and enables it to keep a steady attitude during its trajectory, with face 9 frontwards and face 10 turned towards the rear.

30 This steady attitude favours the correct positioning of the mine whatever the type of ground as will be described hereafter.

The tabs may fold back into housings 15 cut into the shock absorbing structure 4.

35 The free ends of the tabs are situated in a plane 17 which is nearer to the forward face 9 of the mine than to the rear face 10 on which the tabs are fastened.

The length of the tabs is therefore greater than half



01714050965

6

the height H of the mine.

Certain tabs 16a are fitted with an opening 18, they are distributed alternately with other tabs which have no opening.

5 It is therefore possible, by adjusting the length of the tabs and the size of the openings, to vary the position of the aerodynamic centre of the aerodynamic resistance and so adapt the device according to the invention to sub-munitions of a different shape, different
10 mass or ejected at a different speed.

It is also possible to modify the number of tabs 16.

As a variant and according to the characteristics of the mine, openings 18 can be envisaged on all the tabs 16 or there again on none of the tabs.

15 According to another characteristic of the invention, in their deployed position the tabs make an angle with axis 19 of the mine which is such that the diameter D of a circle in which the free ends of the tabs are distributed is one and a half times greater than the height H of the
20 mine (for a mine whose height is roughly equal to half the outside diameter of the shock absorbing structure 4).

This arrangement ensures that, in the event that the mine rebounds off hard ground and lands on its edge after rebound, the tabs would roll the mine over on the ground
25 to rest on one of its faces.

It will also be possible to take advantage of the elasticity of the tabs to cause the mine to become unbalanced when it lands on its edge. Such an unbalance would roll the mine over on the ground to rest on one of
30 its faces.

As a more general rule it must be ensured that the diameter D of the circle as well as the position of the plane 17 in which the free ends of the tabs are situated are such that the position of the mine on its edge is
35 unstable.

Figure 4 shows a second embodiment of the positioning device according to the invention.

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In this particular embodiment face 10, or the rear face of the mine, is fitted with tabs 20b which are distributed at an angle at regular intervals and which are made integral with the mine by means of riveting 13b with the tension rods 11.

Face 9, or the forward face of the mine, is fitted with tabs 20a distributed at an angle at regular intervals.

The free ends of the tabs 20a and 20b are roughly situated in the mid-plane 14 of the mine.

The tabs can fold back into housings 15 cut into the shock absorbing structure 4.

The tabs 20a which are integral with the forward face of the mine 9 are fitted with openings 18a, and the tabs 20b which are integral with the rear face 10 of the mine are fitted with openings 18b.

The size of the openings 18a and 18b is such that the surface area of the tabs 20b integral with the rear face 10 is greater than that of the tabs 20a integral with the forward face 9.

Such an arrangement ensures that the aerodynamic resistance brought by the tab 20b integral with the rear face 10 is greater than that of the tabs 20a integral with the forward face 9.

Therefore the resultant of the aerodynamic resistance which the mine will be subjected to during its ballistic trajectory will have its aerodynamic centre to the rear of the centre of gravity of the mine and the mine will kept a steady attitude during its trajectory, face 9 forwards and face 10 directed towards the rear.

The presence of the tabs 20a on the forward face will help to prevent the mine from sinking too far into soft ground.

In one particularly expedient embodiment of the invention, the tabs will be made by bending metallic wire and spot welding 21 the wire on the washer 5 (see figure 5). The washer 5 is made integral with the forward



face 9 by rivetting 13a the tension rods 11.

As in the previous embodiment of the invention, in their deployed position the tabs make an angle with the axis 19 of the mine which is such that the diameter D of a circle in which the free ends are distributed is greater than that of twice the height H of the mine.

As a variant it is possible to adjust the length of the tabs, the size of the openings and the number of tabs integral with each of the faces.

By so doing it is possible to vary the position of the aerodynamic centre and therefore to adapt the device according to the invention to sub-munitions of a different shape or mass.

Figures 2 to 5 show the positioning devices which are best adapted to mines which are designed to be scattered by tubes or by carriers which are non-rotational or only slightly rotational (such as rockets or gliding missiles).

Figures 6 and 7 show a third embodiment of the positioning device according to the invention, an embodiment which is more particularly designed to be fitted onto mines which are scattered by means of a rotational vehicle, such as an artillery cargo shell.

In this event the mine is fitted with eight tabs which are all fastened to its rear face 10. No tabs are fastened to the forward face 9. The fastening means for the tabs are the same as described hereabove (riveting of the tension rods on the washer which is fitted to the rear face 10).

The tabs are represented on figures 6 and 7 in their non-deformed position. They can be folded back against the mine, their free ends going into the housings cut into the shock-absorbing structure 4.

Figures 8a and 8b represent a single tab 22 according to two mutually perpendicular views.

This tab is composed of folded sheet steel. It comprises a rear pleat 23 in which a hole 24 has been cut enabling the tab to be fastened to the rear face 10 of the



01714050965

9

mine. It also comprises an inward curved tip 25 and a longitudinal opening 26. The opening divides two arms 27a, 27b on the tab 22.

5 The inward curved tip 25 joins the two arms 27a and 27b therein ensuring a certain rigidity of the tab 22 thereby avoiding damage during the assembly phases.

10 The width of the longitudinal opening 26 increases steadily from the base of the tab 22 to its free end. As a result of this arrangement the cross section of the tab decreases steadily from its base to its free end.

15 The variation profile of the section has been selected in such a way that, when the tab is subjected to centrifugal force after being ejected from the mine, the elastic limit of the tab is reached at certain points without the breaking limit having been exceeded. In so doing it is possible to obtain a permanent and controlled deformation of the tabs.

20 The profile of the tab after deformation will be selected so as to give sufficient aerodynamic resistance to the tabs to ensure the stabilization of the mine and enable it to maintain a steady attitude during its trajectory, with face 9 directed towards the front and face 10 directed towards the rear.

25 The practical determination of the appropriate profile will be calculated by the expert using the well known principles of the computation of beams of equal strength to deflection.

30 Figure 8 c shows the mine after being ejected from a cargo shell. The tabs 22 present therein a permanent deformation and their free ends are found distributed in a circle of which the diameter D is greater than twice the height H of the mine.

35 Another advantage of such an embodiment of the invention is that after permanent deformation the tabs retain a certain rigidity which increases the likelihood of the mine being rolled over on the ground onto one of its faces when it lands on its edge after rebounding on

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hard ground.

It is therefore possible to obtain both a significant value for the diameter D and a great rigidity of the tabs when deployed.

5 By adjusting the length of the tabs or their number or even the extent to which they are deformed (and thereby modify their aerodynamic resistance) it is possible to vary the aerodynamic centre of resistance and so adapt the device according to the invention to sub-munitions of a
10 different shape or mass.

It must be noted that, in the particular event of a mine being ejected by means of an artillery cargo shell, the presence of openings 26 modifies only slightly the aerodynamic drag of the tabs 22. This is also true for
15 residual speeds of 220m/s. In this event, it is therefore preferable to adjust the number and size of the tabs.

For the mines which are scattered at low speeds (around 80 to 100m/s) the particular embodiment described hereabove in reference to figures 2 to 5 is better adapted
20 and it will be possible therein to modify the aerodynamic drag by adjusting the size of the openings fitted into the tabs.

As a variant tabs could be made with no openings 26 but wherein the cross section decreases steadily
25 nevertheless from the base of the tab to its free end. The shape of these tabs will be roughly triangular or trapezoide.

Figure 9 represents in diagram form a mine 1 fitted with the positioning device according to the invention
30 landing on soft ground 28.

The presence of the tabs 22 fastened to the rear face
10 ensure that the mine follows through its trajectory with a constant attitude to landing. The the path 29 of the trajectory is marked by means of a dotted line. The
35 mine is represented in 30a and 30b in the last few moments before impact on the ground 28.

The mine touches the ground on its forward face 9



01714050965 11

which sinks into the soft ground. It is prevented from sinking in too far by the presence of the tabs 22.

5 The mine is therefore correctly positioned on the ground .(position 30c) with its rear face 10 roughly parallel to the ground and orientated towards a possible target.

Figures 10a and 10b represent in diagram form a mine 1 fitted with a positioning device according to the invention landing on hard ground 31.

10 The presence of the tabs 22 fastened to the rear face 10 ensure that the mine follows through its trajectory with a constant attitude to landing. The the path 29 of the trajectory is marked by means of a dotted line. The mine is represented in 32a at the moment of impact on hard
15 ground 31.

The mine rebounds and follows a trajectory marked out by the curve 33. It lands after rebound either on one of its faces 9 or 10 (this case which is not represented here corresponds to a correct position of the mine on the
20 ground) or on its edge (position 32c).

In the latter event, the presence of the tabs of which the ends form a circle whose diametre is greater than twice the height of the mine allow the mine to unbalance and roll over (figure 32d or 32f), either towards a stable
25 position 32e with the rear face in contact with the ground, or towards a stable position 32g with the forward face 9 in contact with the ground (figure 10b).

The mine being of the bi-directif type either one of position 32g or 32e enable the subsequent correct
30 operation of the mine.

Naturally it is possible to apply the present invention to other types of sub-munitions, notably to scatterable anti-personnel mines.

35 It is also possible to combine the present embodiment with previous embodiments, in other words to constitute a sub-munition wherein the tabs integral with the rear face of the sub-munition in the direction of its trajectory are



01714050965

12

able to become permanently deformed and wherein the tabs integral with the forward face are comprised for example of bent wires. The forward tabs helping to roll the sub-munition over onto one of its faces in the event of its landing on its edge.

Lastly it is possible to define a sub-munition, of the type of those described in reference to figures 2 to 5, and wherein the tabs are permanently deformed through the action of the aerodynamic resistance to which they are subjected when being ejected.

Such a variant enables the invention to be applied to sub-munitions which are ejected from a scatterer which does not have a rotational motion or wherein the rotational motion is too slow for the centrifugal force to deform the tabs (scatterer of the rocket, missile or bomb type).

In that event the profiles of each tab should be calculated according to the air resistance encountered by the type of scatter selected. The tab will have in any event the shape of a beam with equal strength to deflection.

Such an arrangement enables, as has been described hereabove, the braking power of the sub-munition to be improved since the tabs remain deployed even after braking and it also improves the capacity of the sub-munition to land on hard ground.

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01714050965

13

CLAIMS

1- Positioning device for a sub-munition (1), of the bi-directif scatterable type, and comprising a set of flexible tabs (16,20,22) distributed at regular intervals around the sub-munition, a device characterised in that the distribution of the tabs is such that the resultant of the aerodynamic resistance to which the sub-munition (1) is subjected has its aerodynamic centre just behind the latter's centre of gravity, and in that the tabs (22) integral with a face (10) situated at the rear part of the sub-munition in the direction in which it follows through its trajectory have such a shape that they are subject to a permanent deformation when the mine is being scattered.

2- Positioning device according to Claim 1 and designed to to be fitted onto a sub-munition scattered by means of a vehicle which has a rotational movement, such as an artillery cargo shell, a device characterised in that the tabs are subject to permanent deformation under the effect of the centrifugal force.

3- Positioning device according to one of the Claims 1 or 2, characterised in that the distribution of the tabs (16,22) is such that they are all integral with a face (10) situated on the rear part of the sub-munition (1) in the direction in which it follows through its trajectory.

4- Positioning device according to one of the Claims 1 or 2, characterised in that the distribution of the tabs is such that the aerodynamic resistance resulting from the tabs (20b) integral with a face (10) situated on a rear part of the sub-munition (1) in the direction in which it follows through its trajectory is greater than that of the tabs (20a) integral with a face (9) opposite the rear face (10).

5- Positioning device according to Claim 4, characterised in that the number of tabs (20a) integral

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01714050965

14



with the forward face (9) is equal to that of the tabs (20b) integral with the rear face (10) and in that the surface area of the tabs integral with the rear face is greater than that of the tabs integral with the forward face.

6- Positioning device according to one of the Claims 4 or 5, characterised in that the tabs (20a) integral with the forward face (9) are composed of bent wires.

7- Positioning device according to one of the Claims 1 to 6, characterised in that, in a deployed position, the tabs integral with the rear face (10) of the sub-munition (1) make an angle with the axis of the sub-munition which is such that the diameter (D) of a circle formed by the free ends of the tabs is greater than twice the height (H) of the sub-munition.

8- Positioning device according to one of the Claims 2 to 7, characterised in that the deformable tabs (22) have a geometry such that they have a cross section which decreases steadily from the base of the tab to its free end.

9- Positioning device according to Claim 8, characterised in that the deformable tabs (22) have a longitudinal opening (26) whose width increases steadily from the base of the tab to its free end.

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