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(54) Benevnelse **Warhead**

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The invention relates to a warhead comprising a warhead casing with fragmentation elements disposed on its exterior, which are fixed in their arrangement on the outer casing by holding means.

A warhead with a fragmentation function comprises a warhead casing whose interior is filled with explosive. In order to enable the fragmentation function, fragmentation elements are disposed on the exterior of the mostly cylindrical warhead casing, e.g. in the form of fragmentation plates that explode upon detonation. The fragmentation elements are fixed in their arrangement on the outer casing by holding means.

An example of such a warhead is described in DE 10 2010 027 580 B4. An outer casing is provided there as a holding means that encloses the fragmentation elements and is fixedly mounted on the warhead casing. With the warhead described in DE 10 2010 027 580 B4, the fragmentation elements can be removed during use if required by automatically opening the outer casing that fixes the fragmentation elements, which rest loosely on the warhead casing, in their position, so that the fragmentation elements can fall off. Said automatic opening takes place after the projectile or the missile has been fired, preferably shortly before the actual detonation. This enables the warhead to be ignited as a fragmentation charge if required, wherein in this case the fragmentation elements remain on the warhead until ignition, thus consequently the outer casing is not automatically opened. If, however, the radial fragmentation effect is to be suppressed in order to avoid any collateral damage, the outer casing is opened automatically by suitable means and finally removed, so that the fragmentation elements, which as described are loosely disposed on the warhead and were only fixed by means of the outer casing, can fall off. A fragmentation-free detonation of the warhead now occurs. Said warhead can consequently be operated in two different modes, in one as a warhead with a fragmentation effect and in another as a warhead without a fragmentation effect.

For automatic opening of the outer casing, pyrotechnic means, i.e. ignitable means in the form of cutting cords, are provided there, which are suitably laid to extend under the outer casing. The cutting cords ignite in the manner of a hollow charge, i.e. so that

a linear cutting effect occurs, and the outer casing is separated along the “cut lines” and falls off, whereupon the fragmentation elements are released and drop free.

Because the separation of the outer casing and hence the separation of the cutting plates take place during the flight of the projectile or of the missile, and the separation normally only takes place immediately before the detonation, despite separation having occurred it can occur that the fragmentation plates are still in the immediate detonation region of the main charge at the point in time of the detonation, so that a certain fragmentation effect may occur despite a changeover to the purely blast mode, i.e. to a detonation mode without a fragmentation function.

The invention is therefore based on the problem of specifying a warhead that is improved compared to this.

In order to solve this problem with a warhead of the above-mentioned type, according to the invention it is provided that an element is associated with each fragmentation plate by means of which the fragmentation plate can be actively accelerated away from the warhead casing after releasing the holding means.

According to the invention, the warhead is characterized in that there is the option of the individual fragmentation plates being actively accelerated away from the warhead casing, so that they disperse significantly more rapidly away from the main charge as a result of said active ejection than would be the case for a purely weight-related fall. In this way it is ensured that the fragmentation plates are no longer in the immediate effective circle at the point in time of the detonation, so that the warhead detonates in a purely fragment-free blast mode as intended. Thus if the detonation mode were to be changed over, then the active ejection of the fragmentation plates is carried out immediately by means of the elements at the same time as the release of the holding means fixing the fragmentation plates and the fragmentation plates are accelerated radially outwards.

Different devices can be used as such an element. According to a first alternative of the invention, an ignitable pulse charge can be provided under each fragmentation plate as

a switchable element. For active ejection and dispersal, a pulse charge is consequently ignited under each fragmentation plate, the charge exhibiting an outwardly directed detonation effect and blasting the respective fragmentation plate quasi-radially outwards on ignition. During said ignition, the holding means, by means of which the fragmentation plates are fixed to the warhead casing, are also simultaneously released and the fragmentation plates are released. Said holding means is advantageously implemented as a simple holding wire, which externally encloses the fragmentation plates and holds them in position, but which immediately breaks on ignition of the pulse charges, so that the fragmentation plates are moved away owing to the detonation. The use of a large area outer casing is consequently not necessary here.

The pulse charges themselves can be disposed in a cover that closes the warhead casing adjacent to the respective fragmentation plate. They can be inserted in suitable recesses there, wherein the corresponding ignition lines are led through the cover to the pulse charges. Advantageously, of course all pulse charges are simultaneously ignited by a common ignition signal, regardless of whether they are disposed on a cover or elsewhere.

It is thereby advantageous in principle if the pulse charges, viewed in the direction of flight of the warhead, are disposed on the front end of the fragmentation plates. That is if the active ignition process takes place in the region of the front end of the plate, so that the fragmentation plates are moved outwards with the front end first. Because the warhead is in motion, there is a direct flow under the fragmentation plates from ahead, so that the underflow additionally supports the radial dispersal.

A second alternative embodiment of an active element used for the active dispersal is a spring element, which is initially compressed and is released for active dispersal. According to said configuration of the invention, a spring element fixed in the compressed state by means of a locking device is provided as the element under each fragmentation plate, wherein the locking device can be brought from a locking position into a release position for releasing the spring elements. Thus the active dispersal takes place effectively purely mechanically here by means of the relaxing spring elements, which are preferably suitably designed coil springs. These are initially fixed in the

compressed state by means of a suitable locking device. If a change is to be made from the fragmentation mode to the blast mode, then the locking device is operated correspondingly so that the spring elements are released and act on the fragmentation plates so that these are dispersed simultaneously with the release of the holding means.

A simple wire is also advantageously used here as a holding means, by means of which the fragmentation plates are externally enclosed and which snaps on release of the spring elements by the effectively spontaneously applied, radially outwardly directed force, so that the fragmentation plates can be moved away. It is also advantageous here if the spring elements are positioned in the vicinity of the front fragmentation plate ends when looking in the direction of flight, so that on release of the spring elements here too the fragmentation plates are moved radially outwards with their front ends in the incident flow, wherein the underflow further supports the separation process.

The spring elements themselves are advantageously accommodated in bores in a cover closing the warhead casing, wherein the locking device extends over the respective bore. A dedicated locking device can thereby be associated with each spring element and is thus to be separately operated in order to release the respective spring element. Advantageously, however, a common locking device can also be provided, which on being brought into the release position simultaneously releases all spring elements. In this case consequently only one single movement mechanism is to be provided, which moves the common locking device.

According to an advantageous development of the invention, such a common locking device is designed as a rotating ring, which is rotatably disposed on a cover closing the warhead casing and which can be brought from the locking position into the release position by turning. Said rotating ring comprises corresponding sections, which can be brought in front of the corresponding bores for retaining the spring elements, and which are moved to the side by turning the cover into the release position.

In order to enable said rotation, according to a development of the invention another spring element is provided that is associated with the rotating ring. Said spring element is compressed with the rotating ring in the locking position, in which the rotating ring

is self-locking. Once the locking of the rotating ring is released, the relaxing spring element, again e.g. a coil spring, can move the rotating ring into the release position, thereby releasing the springs.

In principle, in order to bring the or each locking device into the release position regardless of how this is designed, at least one controllable actuator is provided, i.e. an element that can be actively controlled in order to carry out an action that causes a movement of the locking element. Preferably, an ignitable pulse charge is provided as an actuator, which sets a movement mechanism in motion as a result of a detonation, which causes movement of the locking element(s).

According to a particularly preferred embodiment of the invention, the actuator, especially the pulse charge, interacts with the locking element used for locking the rotating ring. That is, the actuator is used to release the rotating ring locking means, whereupon the latter is brought by means of the already described spring element from the position locking the spring elements associated with the fragmentation plates into the release position.

For this purpose, the pulse charge can be disposed in an aperture in the cover and can interact with a pin forming the locking element of the rotating ring, which engages in a bore of the rotating ring, such that on ignition of the pulse charge the pin is moved out of the bore. If the pin is withdrawn from the bore the rotating ring is released, so that it is turned by the effect of the relaxing spring element. The fragmentation plate springs are released and active dispersal occurs.

As already described, a wire is preferably provided as a holding means, being externally tensioned around all fragmentation plates. Regardless of which of the elements is specifically used for active dispersal, said wire is always designed such that it snaps on activation of the element(s) and the fragmentation plates are released. A suitable band can of course be used as an alternative to a wire, as of course a complete outer casing can be used, but this is not designed to be stable in any case. Rather, it is designed such that the fragmentation plates are fixed on the one hand, but on the other hand such that it breaks immediately when the element(s) is/are activated.

Other advantages, features and details of the invention arise from the exemplary embodiments described below and using the figures. In the figures:

Fig. 1 shows a basic representation of a warhead according to the invention of a first embodiment in a partial section,

Fig. 2 shows the warhead of Fig. 1 that is not sectioned,

Fig. 3 shows a basic representation of the operation of the active fragmentation plate separation,

Fig. 4 shows a view of a cover of a warhead of a second embodiment according to the invention,

Fig. 5 shows a view of a rotating ring 5 to be placed on the cover of Fig. 4, and

Fig. 6 shows a partial view of a warhead of the second embodiment according to the invention in a sectional representation.

Fig. 1 shows a partially sectional view of a warhead 1 according to the invention of a first embodiment. It consists of a warhead casing 2, preferably of CFK material, which is closed on one side by a housing floor 3 and on the other side by a cover 4. The main charge 5 and an associated booster 6 are disposed therein. On the outside the warhead casing 2 is populated by loosely placed fragmentation plates 7, wherein in the exemplary embodiment shown four fragmentation plates 7 are provided, each covering approx. 90°. The fragmentation plates 7 are fixed in their position on the warhead casing 2 by means of a holding means 8, in this case a wire 9 that passes around the exterior of the fragmentation plates. The holding wire 9 is designed such that it snaps when a force is exerted on the fragmentation plates from underneath the fragmentation plates in order to actively disperse the same away from the warhead 1.

A device is provided on the cover 4 itself beside the actual detonator 10 that enables the individual fragmentation plates 7 to be actively moved away from the warhead 1 as required. For this purpose, a total of four elements 11 are provided, wherein each element is associated with a fragmentation plate 7 or is disposed under the same on the cover 4. The individual elements 11 are implemented here in the form of pulse charges 12, i.e. pyrotechnic elements, which can be simultaneously ignited under the control of a control device that is not shown here. The cover 4 and with it the pulse charges 12 are disposed (which will be discussed below) in the vicinity of the front end of the warhead 1 when looking in the direction of flight, therefore the pulse charges 12 are thus disposed below and adjacent to the front ends of the fragmentation plates 7.

The warhead 1 can be ignited in two different operating modes. In a first operating mode it can detonate with a fragmentation effect, i.e. so that on ignition of the booster 6 or the main charge 5 by the detonator 10 the fragmentation plates 7 are disposed on the warhead 1. The normally pre-notched fragmentation plates of steel fragment on detonation, so that the individual fragments move away.

In a second operating mode the warhead detonates after the fragmentation plates 7 have previously been actively ejected. In this case a pure blast effect is used without any fragmentation effect. In order to enable this, the elements 11 are simultaneously controlled and the pulse charges 12 are simultaneously ignited as well. They are disposed in corresponding cover receptacles 13 and are thus encapsulated relative to the inside of the cover, so that the entire detonation effect is directed radially outwards and directly against the inner surfaces of the fragmentation plates 7. A large force consequently acts upon the same at the point in time of ignition of the pulse charges 12. On the one hand this is sufficient to break the holding wire 9, on the other hand the fragmentation plates 7 are actively forced away by this with their front ends radially outwards when looking in the direction of flight. The fragmentation plates 7 are consequently actively ejected by ignition of the pulse charges 12 and are accelerated away from the warhead casing, so that if the main charge 5 detonates shortly thereafter they are no longer in the direct sphere of action of the main charge detonation.

The usefulness of the arrangement of the elements 11 or rather the pulse charges 12 below the front end of the fragmentation plates 7 can be seen in Fig. 3. A missile 14 comprising a warhead 1 according to the invention is shown in this figure, wherein two fragmentation plates 7 are illustrated here only by way of example. At the point in time t0 the missile 14 is on its flight path, being as before in the fragmentation mode, according to which the fragmentation plates 7 are still on the warhead. At the point in time t1 the changeover from the fragmentation mode to the blast mode takes place, i.e. such that the pulse charges 12 are ignited. It can be seen that the fragmentation plates 7 are accelerated away radially outwards with their front ends first, so that they are arranged against the direction of flight. A flow incident upon or below the fragmentation plates 7 occurs, the fragmentation plates being accelerated away from the missile 14 (see the illustration at the following point in time t2) not only by the detonation effect of the pulse charges 12, but also assisted by the underflow. The missile then detonates, wherein the fragmentation plates 7 are already far removed from the missile during the detonation.

Figs. 4 to 6 show another embodiment of a warhead according to the invention, wherein the same reference characters are used for the same components.

The basic design of the warhead 1 according to Figs. 4 to 6 corresponds to that depicted in Fig. 1. Here too (see Fig. 6) a warhead casing 2 is provided, which is closed by a (not shown here in detail) housing floor 3 and a cover 4. There is again a main charge 5 plus booster 6 therein, the detonator (not shown here in detail) is provided on the cover, and in turn there are elements 11, which are used for the active radial dispersal of the fragmentation plates 7, of which preferably again four are disposed on the warhead casing 2. Here too the fragmentation plates 7 are fixed by means of a holding means in the form of a thin holding wire 9, wherein here too for active dispersal the holding wire 9 snaps on activation of the elements 11.

The elements 11 are implemented here as spring elements 15, which are accommodated in corresponding radially oriented bores 16 in the cover 4. Four fragmentation plates 7 having been provided, four spring elements 15 are also provided in corresponding bores 16.

The spring elements 15, e.g. coil springs, are strongly compressed in the base position. For this purpose, a locking element 17 in the form of a rotating ring 18 is used, which is rotatably disposed on the cover 4. The cover 4 comprises for this a circumferential annular groove 19, in which an axial flange 20 of the rotating ring 18 engages. Four locking sections 21 are provided on the exterior of the rotating ring 18, which (see Fig. 6) lie in front of the bores 16 of the cover 4 in the locking position of the rotating ring 18, so that the spring elements 15 accommodated therein are held in their strongly compressed form. The locking sections 21 can be seen to lie below the respective fragmentation plate 7. They pass through slots 22 provided on the cover 4 - see the view of the cover according to Fig. 4 for this.

Furthermore, a curved aperture 23 is provided on the cover 4, in which another spring element 24 (see Fig. 6), here too preferably a coil spring, is accommodated. Said spring element 24 is supported with one end on a stop 25 of the aperture 23, with the other end the spring element rests on a counter stop 26 of the rotating ring 18 and said counter stop 26 engages in the aperture 23. In the initial position, if the rotating ring 18 is in its locking position, the spring elements 15 are consequently also held compressed in their bores 16 and the spring element 24 is also compressed. In order to ensure this, the rotating ring 18 is itself locked, for which a locking element 27 is used, in this case in the form of a locking pin 28 that can be moved by means of an actuator 29, in this case an ignitable pulse charge 30. The pulse charge 30 and also the pin 28 are accommodated in another aperture 31 in the cover 4. The pin 28 extends through an opening 32 in the aperture and engages a bore 33 in the annular flange 20 of the rotating ring 18 (see Figs. 5 and 6). The rotating ring 18 is fixed by this means in its locking position, in which the locking sections 21 are in front of the bores 16.

If an active ejection of the fragmentation plates 7 is now to take place for a changeover from the fragmentation mode to the blast mode, then the pulse charge 30 is ignited by means of a control device that is also not shown here in detail. This results in the pin 28 being retracted, i.e. such that it is withdrawn from the bore 33, and the rotating ring 18 is released by this means. The previously fixed spring element 24 relaxes and the now freely rotatable rotating ring 18 is turned as a result of the contact of the spring

element 24 with the counter stop 26 on the housing 4. The locking sections 21 are hereby moved out of their positions in front of the bores 16 and the bores 16 become open. Simultaneously with the opening, the strongly compressed spring elements 15 rapidly exit the bores 16 and strike the inner sides of the fragmentation plates 7. As a result of the quasi-explosive pressure increase of the fragmentation plates 7 against the wire 9 this snaps, the spring elements 15 relax still further and actively move the fragmentation plates 7 away from the warhead casing 2. The same effect occurs as already described in relation to Fig. 3 because here too the elements 11 in the form of the spring elements 15 engage the fragmentation plates 7 in the vicinity of the front ends when looking in the direction of flight.

The rotary motion of the rotating ring 18 takes place until the locking sections 21 strike the ends of the slots 22. The length of the slots and the design of the spring element 24 are preferably dimensioned such that the spring element 24 is not yet fully relaxed, but the rotating ring 18 is affected as above and is consequently pressed against the slot ends, so that it is also fixed in the release position by this means.

Although in the example shown a pulse charge 30 is described as an actuator 29, it would be conceivable that a different actuator could be used, e.g. an electromagnetic element that retracts the pin 28 in an effectively magnetic manner.

Patentkrav

1. Stridshode omfattende en stridshodeforing med splitteplater anbrakt på eksteriøret som er festet i deres arrangement på utsiden ved hjelp av et festearrangement, **karakterisert ved at** et element (11) er forbundet med hver luftmotstandsreduserende plate (7), ved hjelp av hvilke splitteplaten (7) kan aktivt akselereres vekk fra stridshodeforingen (2) etter utgivelsen av et festearrangement (8).

2. Stridshode ifølge krav 1, **karakterisert ved at** en antennelig pulsladning (12) er tilveiebrakt som et byttbart element (11) under hver splitteplate (7).

3. Stridshode ifølge krav 2, **karakterisert ved at**, pulsladningene (12) er anbrakt i et deksel (4) ved avslutning av stridshodeforingen (2) ved siden av de respektive splitteplater (7).

4. Stridshode ifølge krav 2 eller 3, **karakterisert ved at**, pulsladninger (12), sett i fluktretningen til stridshodet (1), er anbrakt på den førende enden til splitteplatene (7).

5. Stridshode ifølge et av kravene 2 til 4, **karakterisert ved at** alle pulsladninger (12) kan bli antent samtidig av et felles tenningssignal.

6. Stridshode ifølge krav 1, **karakterisert ved at** et fjærelement (15) som er festet i den komprimerte tilstand ved hjelp av en låseenhet (17) er anbrakt som elementet (11) under hver splitteplate (7), hvor låseenheten (17) kan bli brakt inn i en frigjørings-posisjon for frigjøring av fjærelementet (15).

7. Stridshode ifølge krav 6, **karakterisert ved at** fjærelementene (15) er anbrakt i boringer (16) i et deksel (4) som avslutter stridshodeforingen (2), hvor låseenheten (17) strekker seg over de respektive boringer (16).

8. Stridshode ifølge krav 6 eller 7, **karakterisert ved at** en egen låseenhet er forbundet med hvert fjærelement (15), eller en felles låseenhet (17) som samtidig frigjør alle fjærelementene (15) når de bringes i frigjøringsposisjonen.

9. Stridshode ifølge krav 8, **karakterisert ved at** den felles låseenheten (17) er en roterende ring (18) som er roterbart anbrakt på et deksel (4) som avslutter stridshode-foringen (2) og som kan bringes fra låseposisjon til frigjøringsposisjon ved vridning.

10. Stridshode ifølge krav 9, **karakterisert ved at** et ytterligere fjærelement (24) er forbundet med den roterende ringen (18), som blir sammenpresset med den roterende ringen (18) og selv er låst i låseposisjonen, og beveger den roterende ring (18) inn i frigjøringsposisjonen når låsingen av den roterende ringen (18) frigjøres.

11. Stridshode ifølge ett av kravene 6 til 10. **karakterisert ved at** i det minste et sluttkontrollelement (29) som kan bli aktivert er anbrakt for å bringe låseenheten (17) eller hver låseenhet (17) til frigjøringsposisjonen.

12. Stridshode ifølge krav 11, **karakterisert ved at** sluttkontrollelementet (29) er en antennelig pulsladning (30).

13. Stridshode ifølge krav 10 og krav 11 eller 12, **karakterisert ved at** sluttkontroll-elementet (29), særlig pulsladningen (30) arbeider sammen med låseelementet (27) som brukes til låsing av den roterende ringen (18).

14. Stridshode ifølge krav 13, **karakterisert ved at** sluttkontrollelementet (29), særlig pulsladningen (30), er anbrakt i en utsparing (31) til dekslet (4) og samvirker med en tapp (28) som danner låseelementet (27), som griper inn i en boring (33) til den roterende ringen (18), slik at tappen (28) er flyttet ut av boringen (33) når sluttkontroll-elementet (29) opereres, særlig for å tenne pulsladningen (12).

15. Stridshode ifølge ett av kravene 6 til 14, **karakterisert ved at** fjærelementene (16), sett i fluktretningen til stridshodet (1), er anbragt ved den fremre enden til splitteplatene (7).

16. Stridshode ifølge ett av de foregående krav, **karakterisert ved at** feste-arrangementet (8) er en vaier (9) som er strukket utover rundt alle splitteplatene (7).

FIG. 1

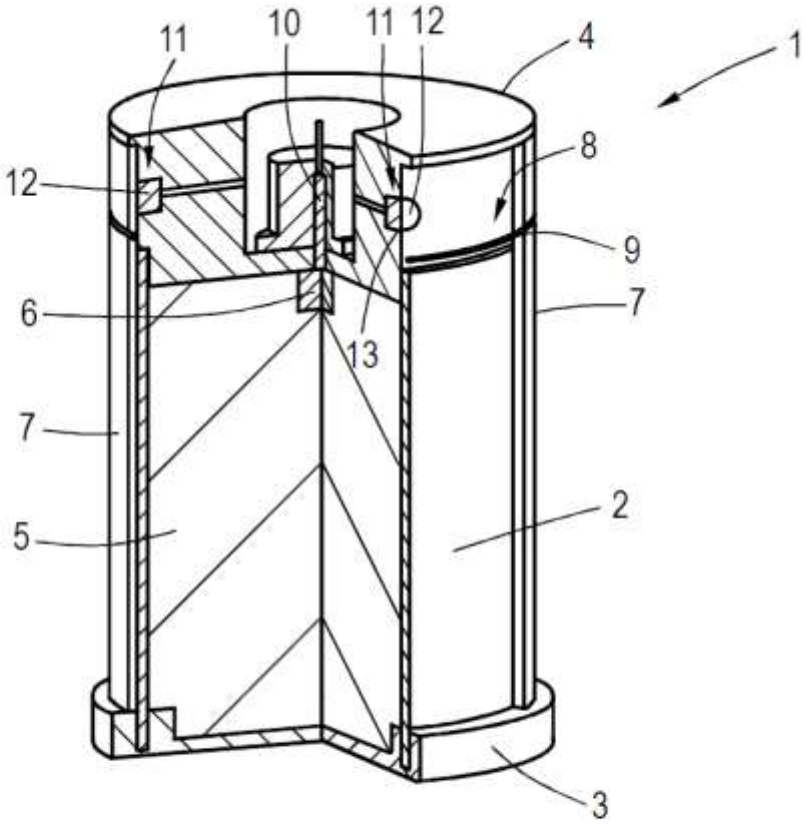

FIG. 2

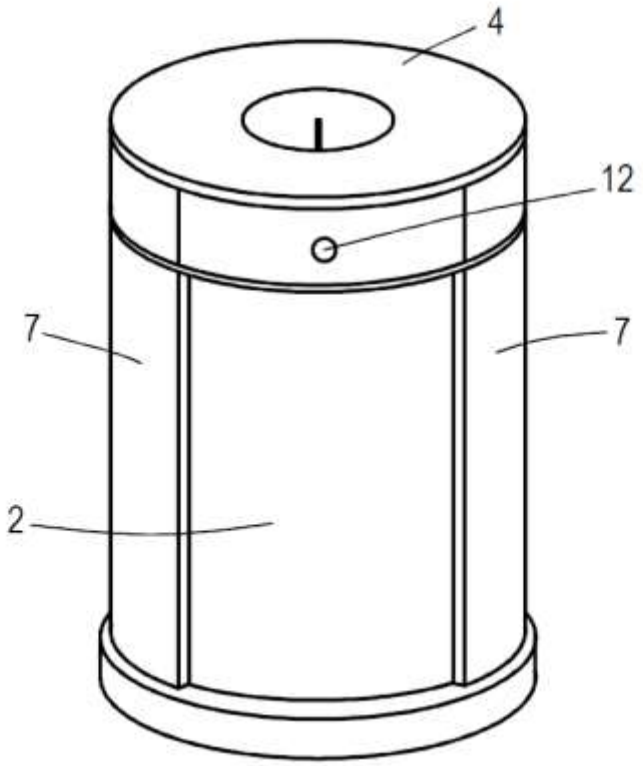

FIG. 3

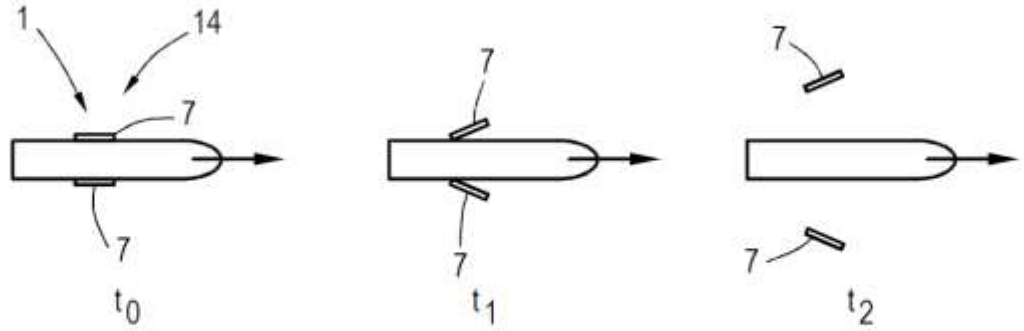

FIG. 4

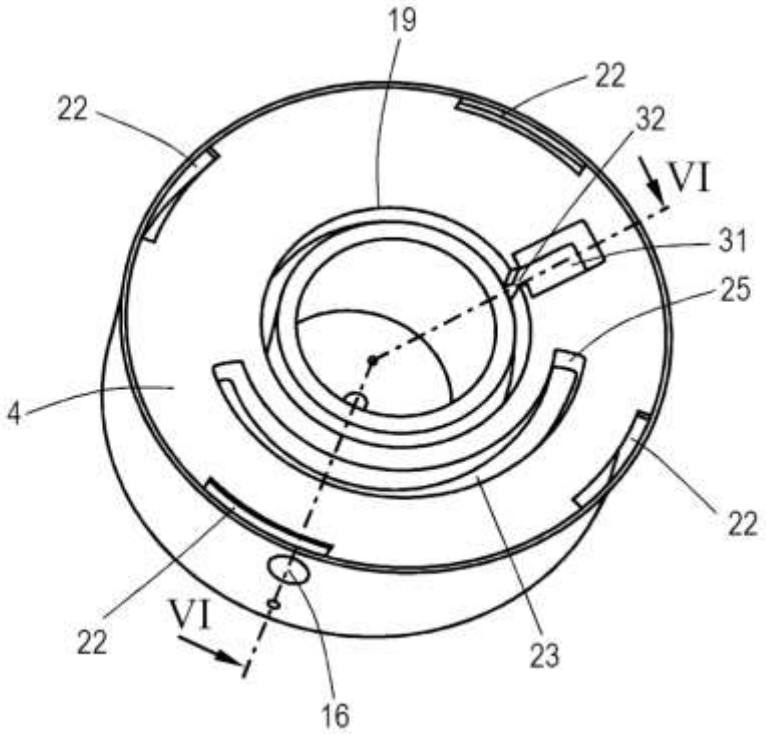

FIG. 5

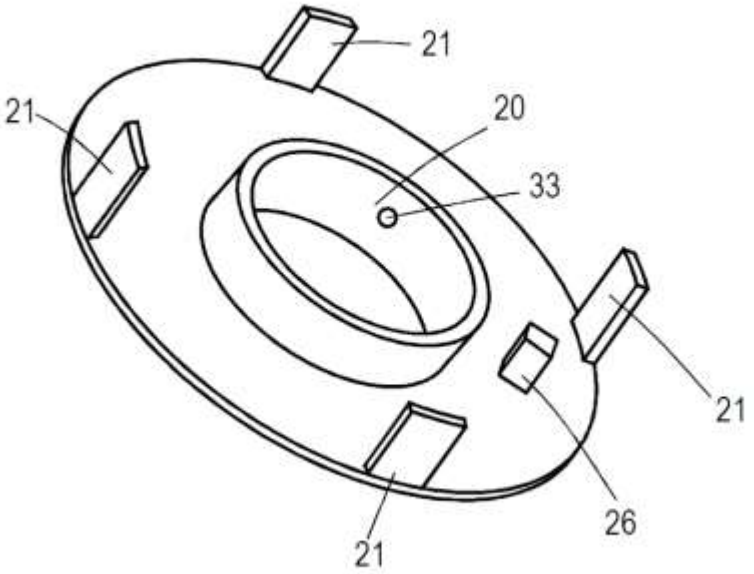

FIG. 6