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

(11) **EP 1 637 829 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
31.05.2017 Bulletin 2017/22

(51) Int Cl.:
F42B 4/26 *(2006.01)* ***F41J 2/02*** *(2006.01)*

(21) Application number: **04445095.5**

(22) Date of filing: **15.09.2004**

(54) **Pack of heat-generating countermeasures**

Hitzegenerierendes Gegenmassnahmenpaket

Paquet de contre-mesures générant de la chaleur

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR

(43) Date of publication of application:
22.03.2006 Bulletin 2006/12

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(56) References cited:
WO-A-2004/070310
DE-A- 19 758 421
US-A- 3 770 525
US-A- 4 978 400
US-A- 5 472 533
US-A- 6 055 909
US-B1- 6 312 625
US-B1- 6 427 599

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Description

[0001] In accordance with the preamble of independent claim 1, the present invention relates to a pack of heat-generating countermeasures comprising a container with a lid forming a tight-closing pack and accommodating heat-generating countermeasures in the form of material which oxidizes on contact with oxygen and thus generates heat, which is intended to be dispensed from sea, land or air-based systems, heat being generated when the pack, on being dispensed, is opened so that the contents of the pack come into contact with the oxygen in the air and are oxidized. Packs of this kind are used for generating decoys to counter heat-seeking homing missiles.

[0002] A common type of decoy to counter heat-seeking homing missiles is hot bodies which are placed in the field of vision of the missile and are intended to disrupt the target seeker. Conventionally, pyrotechnic magnesium-based flares have been used. These maintain a relatively high temperature, which means that the ratio between the heat signature of the flare and the signature of the aircraft tends to be greater than one, which is normally attractive to a thermal-target seeker. More modern thermal-target seekers may be equipped with filters and other devices which, using various techniques, distinguish such flares. It is therefore of interest instead to make use of oxidizing heat-generating material with a lower temperature and a larger radiating area, which can obtain a ratio between the oxidizing heat-generating material and the heat signature of the aircraft which is greater than one without activating these filters and other devices.

[0003] In this connection, it is previously known from our Swedish patent application 0300322-5 to use oxidizing material in the form of oxidizing iron sulphide in powder form or coated on a substrate, for example a metal strip. In the latter case, the substrate is heated by the oxidizing material and acts as a black or grey body radiator. In this connection, black body means an ideal heat radiator which behaves according to Planck's law, while a grey body is a body of which the radiation properties have the same spectral distribution as a black body but not the same intensity. The substrate therefore acts as both a carrier and a grey body radiator in the form of a heat buffer but not as a heat generator.

[0004] In utilization of the technique with oxidizing heat-generating material, it is inter alia desirable to:

1. maximize the quantity of oxidizing material in a given volume.

2. adapt the oxidation properties of the oxidizing material to the situation in which it is to be used, for example to the heat signature of the platform or to the characteristics of the expected threat.

3. minimize the quantity of material which lands on the ground after use. This is of particular importance when used in civil aviation.

[0005] The object of the present invention is to produce a pack of heat-generating countermeasures which satisfies the wishes referred to above better than previously known constructions. The object of the invention is achieved in accordance with the characterizing part of independent claim 1 by a pack characterized in that the oxidizing material consists essentially of oxidizing powder joined together to form one or more joined-together bodies. The oxidizing heat-generating bodies are therefore completely or virtually completely constructed from oxidizing material, which means that they act as carrier, heat generator and grey body radiator at one and the same time. By using the oxidizing material as a grey radiator, a greater quantity of oxidizing material can be enclosed within a given volume. This can be utilized in order, for example, to generate a longer burning time or alternatively a greater radiating area per given volume. Moreover, the maximum operating temperature and rise time of the bodies can be controlled and adapted to the situation in which they are to be used. After use, the oxidizing heat-generating bodies will have burned up completely or virtually completely before they reach the ground, which minimizes contamination on the ground or platform.

[0006] According to an advantageous embodiment of the invention, the joined-together bodies formed by joining the oxidizing powder together consist essentially of iron sulphide. The joining-together can be effected by, for example, a sintering process to form a body of suitable shape and mass.

[0007] Alternatively, the joined-together bodies can consist essentially of a pure metal such as iron or aluminium.

[0008] In order to hold the bodies formed by the joined-together powder together, the bodies can, according to another advantageous embodiment, comprise binder. Alternatively, the bodies can comprise reinforcement or binder and reinforcement in combination. The reinforcement can be in the form of, for example, glass fibre, and the binder can be in the form of, for example, potassium bromide.

[0009] According to another advantageous embodiment, the bodies include substances which, when oxidation of the oxidizing material takes place, give off exhaust-gas-like gases, such as, for example, CO, CO_2 or H_2O. By imitating the gases which are found in proximity to the exhaust discharge of an engine while generating heat radiation in certain frequency bands, it is possible to make it more difficult for certain advanced heat-seeking homing missiles to distinguish the oxidizing heat-generating bodies as decoys.

[0010] The decisive factors for the action of the oxidizing heat-generating bodies against a heat-seeking homing missile are their temperature, their emissivity, their number, the spread of the bodies in the space within the

field of vision of the target seeker and their radiating area projected in the field of vision of the missile. The time it takes for the body to reach its operating temperature from ambient temperature and how long the body is capable of maintaining this temperature also have an effect. The design of the body will also control the way in which the body is cooled by conduction and convection and influence its aerodynamic qualities. It is therefore desirable for it to be possible to vary the design of the bodies according to application, that is to say according to the platform to be protected and according to the threat which can be expected.

[0011] The oxidizing heat-generating bodies are of the nature of a pellet. The shape of the bodies can therefore be adapted so that all the characteristics mentioned above are adapted to the demands made in an operational situation. An important parameter controlled by the shape is the ratio between surface area and volume. The larger the surface area exposed to air, the greater the effect produced. A higher ratio therefore gives a higher temperature but a shorter burning time for a given volume (mass). Generally, it can also be said that cooling and air resistance increase as the ratio increases. A typical design of the oxidizing heat-generating bodies which tends to give a high burning temperature is a rectangular or square body with a thin cross section. Such a body is suitable for protecting a platform with high heat radiation of its own. Such a body also has an extent and shape suitable for packing in a box. By increasing the thickness of the body, but retaining the same basic shape, a lower burning temperature and a smaller radiating area but a longer burning time are obtained. Such a body is suitable for protecting a platform with a lower heat radiation of its own and a lower speed, which means that the body will remain in the field of vision of the target seeker for a longer time, for which reason a longer burning time is desirable. A typical such platform is a slow-moving transport aircraft or a civil passenger aircraft.

[0012] It is clear from the above that the joined-together bodies can have a varying shape depending on the requirements in an operational situation. In this context, however, two shape types are indicated.

[0013] In this connection, according to a first advantageous embodiment of the pack, the bodies are designed with an essentially spherical shape. By virtue of their spherical shape, good strength and a slow oxidization process are obtained.

[0014] According to a second advantageous embodiment, the bodies are designed with an essentially flat rectangular shape. The shape allows the space in standardized flat containers for countermeasures to be filled efficiently. By changing the thickness, for example, the burning time and burning temperature can be adjusted.

[0015] The invention will be described in greater detail below by means of an illustrative embodiment with reference to accompanying drawings, in which:

Figure 1 shows diagrammatically in a longitudinal section a dispenser loaded with packs of countermeasures according to the invention;

Figure 2 shows diagrammatically a pack of heat-generating countermeasures according to the invention;

Figures 3a-c show three examples of suitable shapes for the joined-together bodies which constitute the oxidizing material of the pack, and

Figure 4 shows examples of burning profile based on burning temperature as a function of time.

[0016] The dispenser 1 shown diagrammatically in Figure 1 is filled with packs 2 which, when opened, generate heat. A spring-loaded piston 3 displaces the packs towards the opening 4 of the dispenser 1 where a mechanical launching mechanism 5 launches one pack at a time through the opening 4. Adjacent to the opening 4 is an opening mechanism 6 for opening the packs in connection with their being launched or dispensed. The opening mechanism 6 can comprise some form of gripping means which takes hold of and pulls off an openable part of the pack. Alternatively, the opening mechanism can comprise some form of cutting means, for example a knife, which cuts open the pack in connection with it leaving the dispenser.

[0017] The pack 2 shown in Figure 2 comprises a container 7 consisting of a bottom plate 8 and four side walls 9-12. The container is closed by a lid 13 which can be, for example, glued firmly to the edges of the side walls 9-12 facing the lid 13. The container accommodates joined-together bodies 14 indicated by broken lines which constitute oxidizing material and thus react with oxygen, generating heat, when the pack is opened and the air is given access. In this example, the bodies are indicated as having a flat rectangular shape, but there are many other possible shapes.

[0018] Examples of shapes which may be suitable for the joined-together bodies are shown in Figure 3. Figure 3a shows a spherical shape. The spherical shape has a small surface area in relation to volume and can advantageously be used if a long burning time is required. The spheres can be given a larger or smaller diameter depending on the desired effect. It may also be suitable to mix different sizes. The bodies 14 shown in Figures 3b and 3c have two plane opposite rectangular main surfaces 19, 20, and the one shown in Figure 3c is more elongate than the one shown in Figure 3b. By varying the thickness of the bodies, for example, the burning time and burning temperature can be changed. In principle, it can be said that a thicker body with the same volume as a thinner one gives a lower burning temperature and longer burning time. The shapes shown in Figures 3b and 3c lend themselves especially well to being packed in the type of pack shown in Figure 2. The bodies can relatively easily be dimensioned so that they fill the entire interior of the pack.

[0019] Figure 4 shows examples of how the burning temperature T can vary as a function of time t. In this connection, the upper curve 15 shows a burning profile with a relatively high burning temperature and short burning time, while the lower curve 16 shows a burning profile with a relatively low burning temperature and long burning time. It can be useful if the front flanks 17, 18 of the curves are relatively steep so that the countermeasures work with full force quickly.

[0020] The invention is not limited to the embodiments shown as examples above but can undergo modifications within the scope of the patent claims below.

Claims

1. Pack of heat-generating countermeasures comprising a container with a lid forming a tight-closing pack and accommodating heat-generating countermeasures in the form of material which oxidizes on contact with oxygen and thus generates heat, which pack is intended to be dispensed from sea, land or air-based systems, heat being generated when the pack, on being dispensed, is opened so that the contents of the pack come into contact with the oxygen in the air and are oxidized, **characterized in that** the oxidizing material consists essentially of oxidizing powder joined together to form one or more joined-together bodies, the oxidizing heat-generating bodies being completely or virtually completely constructed from oxidizing material, wherein said bodies act as carrier, heat generator and grey body radiator at one and the same time.

2. Pack according to patent claim 1, **characterized in that** the joined-together bodies formed by joining the powder together consist essentially of iron sulphide.

3. Pack according to patent claim 1, **characterized in that** the joined-together bodies consist essentially of pure metal such as iron or aluminium.

4. Pack according to any one of the preceding patent claims, **characterized in that** the bodies formed by the joined-together powder comprise binder in order to hold the individual body together.

5. Pack according to any one of the preceding patent claims, **characterized in that** the bodies formed by the joined-together powder comprise reinforcement in order to hold the individual body together.

6. Pack according to any one of the preceding patent claims, **characterized in that** the bodies include substances which, when oxidation of the oxidizing material takes place, give off exhaust-gas-like gases, such as, for example, CO, CO2 or H2O.

7. Pack according to any one of the preceding patent claims, **characterized in that** the bodies are designed with essentially spherical shape.

8. Pack according to any one of preceding patent claims 1-6, **characterized in that** the bodies are designed with an essentially flat rectangular shape.

Patentansprüche

1. Packung von wärmeerzeugenden Gegenmaßnahmen bzw. Täuschkörpern, umfassend einen Behälter mit einem Deckel, der eine dicht schließende Packung bildet und wärmeerzeugende Täuschkörper in Form von Material aufnimmt, welches bei Kontakt mit Sauerstoff oxidiert und somit Wärme erzeugt, wobei die Packung dazu bestimmt ist, von see-, land- oder luftgestützten Systemen abgegeben zu werden, wobei Wärme erzeugt wird, wenn die Packung, wenn sie abgegeben wird, geöffnet wird, so dass der Inhalt der Packung in Kontakt mit dem Sauerstoff in der Luft kommt und oxidiert wird, **dadurch gekennzeichnet, dass** das oxidierende Material im Wesentlichen aus oxidierendem Pulver besteht, das zusammengefügt ist, um einen oder mehrere zusammengefügte Körper zu bilden, wobei die oxidierenden wärmeerzeugenden Körper vollständig oder nahezu vollständig aus oxidierendem Material konstruiert sind, wobei die Körper gleichzeitig als Träger, Wärmeerzeuger und Graukörperstrahler fungieren.

2. Packung gemäß Patentanspruch 1, **dadurch gekennzeichnet, dass** die zusammengefüg-ten Körper, die durch Zusammenfügen des Pulvers gebildet sind, im Wesentlichen aus Eisensulfid bestehen.

3. Packung gemäß Patentanspruch 1, **dadurch gekennzeichnet, dass** die zusammengefüg-ten Körper im Wesentlichen aus reinem Metall wie Eisen oder Aluminium bestehen.

4. Packung gemäß einem der vorangehenden Patentansprüche, **dadurch gekennzeichnet, dass** die durch das zusammengefügte Pulver gebildeten Körper ein Bindemittel umfassen, um den einzelnen Körper zusammenzuhalten.

5. Packung gemäß einem der vorangehenden Patentansprüche, **dadurch gekennzeichnet, dass** die durch das zusammengefügte Pulver gebildeten Körper eine Verstärkung umfas-sen, um den einzelnen Körper zusammenzuhalten.

6. Packung gemäß einem der vorangehenden Patentansprüche, **dadurch gekennzeichnet, dass** die Körper Substanzen enthalten, welche, wenn die Oxidation des oxidierenden Materials stattfindet, abga-

sähnliche Gase wie z. B. CO, CO_2 oder H_2O abgeben.

7. Packung gemäß einem der vorangehenden Patentansprüche, **dadurch gekennzeichnet, dass** die Körper mit im Wesentlichen kugelförmiger Gestalt ausgebildet sind.

8. Packung gemäß einem der vorangehenden Patentansprüche 1-6, **dadurch gekennzeichnet, dass** die Körper mit einer im Wesentlichen flachen rechteckigen Gestalt ausgebildet sind.

Revendications

1. Ensemble de contre-mesures à génération de chaleur comprenant un récipient avec un couvercle formant un ensemble hermétiquement fermé et logeant des contre-mesures à génération de chaleur se présentant sous la forme d'un matériau qui s'oxyde en contact avec l'oxygène et génère ainsi de la chaleur, lequel ensemble est prévu pour être distribué à partir de systèmes maritimes, terrestres ou aériens , la chaleur étant générée lorsque l'ensemble, après avoir été distribué, est ouvert de sorte que le contenu de son ensemble vient en contact avec l'oxygène dans l'air et est oxydé, **caractérisé en ce que** le matériau d'oxydation se compose essentiellement de poudre d'oxydation assemblée pour former un ou plusieurs corps assemblés, les corps d'oxydation de génération de chaleur étant complètement ou pratiquement complètement construits à partir de matériau d'oxydation,
dans lequel lesdits corps servent de support, de générateur de chaleur et de radiateur à corps gris en une seule et même fois.

2. Ensemble selon la revendication 1, **caractérisé en ce que** les corps assemblés formés en assemblant la poudre se composent essentiellement de sulfure de fer.

3. Ensemble selon la revendication 1, **caractérisé en ce que** les corps assemblés se composent essentiellement de métal pur tel que le fer ou l'aluminium.

4. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les corps formés par la poudre assemblée comprennent un liant afin de maintenir le corps individuel.

5. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les corps formés par la poudre assemblée comprennent un renforcement afin de maintenir le corps individuel.

6. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les corps comprennent des substances qui, lorsque l'oxydation du matériau d'oxydation a lieu, émettent des gaz tels que des gaz d'échappement, tels que par exemple le CO, le CO_2 ou le H_2O.

7. Ensemble selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les corps sont conçus avec une forme essentiellement sphérique.

8. Ensemble selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** les corps sont conçus avec une forme rectangulaire essentiellement plate.

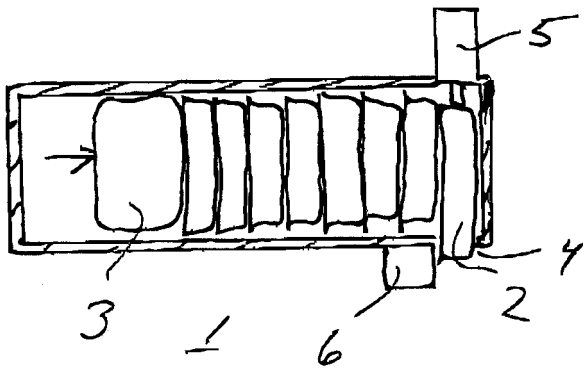


Fig. 1

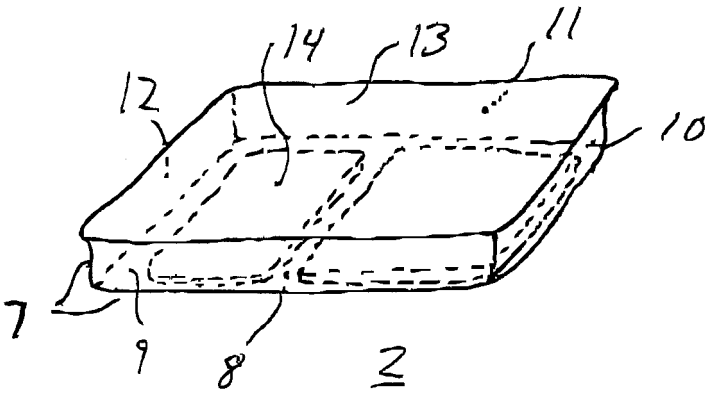


Fig. 2

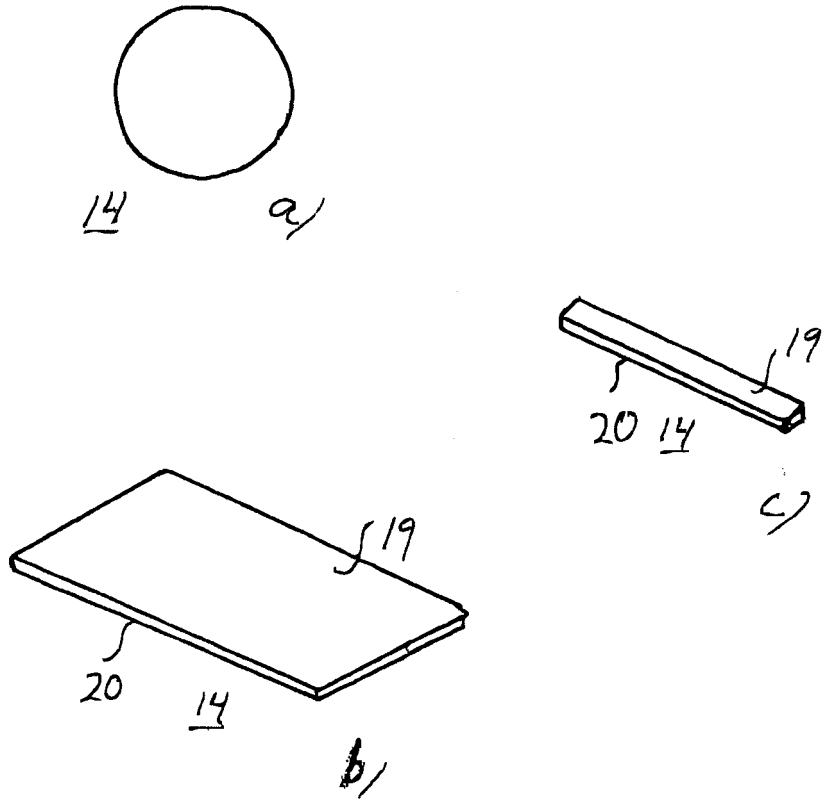


Fig. 3

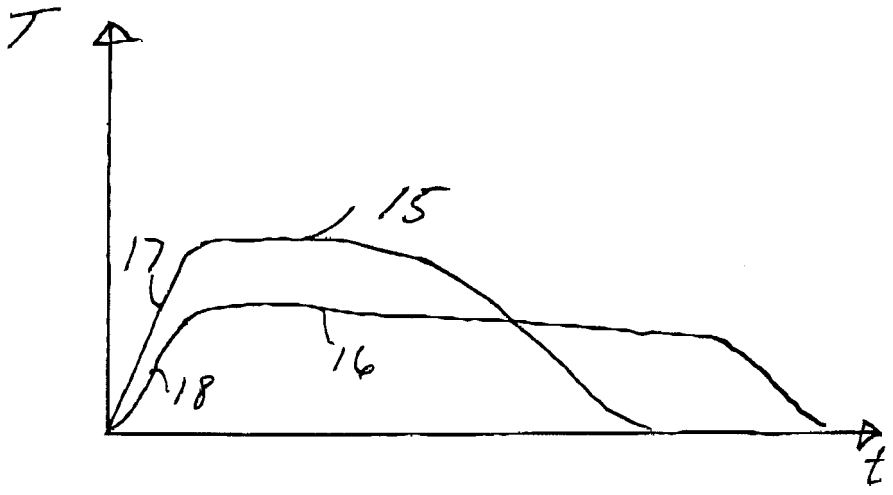


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- SE 03003225 **[0003]**