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(11) **EP 1 175 921 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.01.2002 Bulletin 2002/05

(51) Int Cl.7: **A62C 3/07**, A62C 13/22,
A62C 39/00

(21) Application number: **01830441.0**

(22) Date of filing: **28.06.2001**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

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(30) Priority: **28.07.2000 IT TO000752**

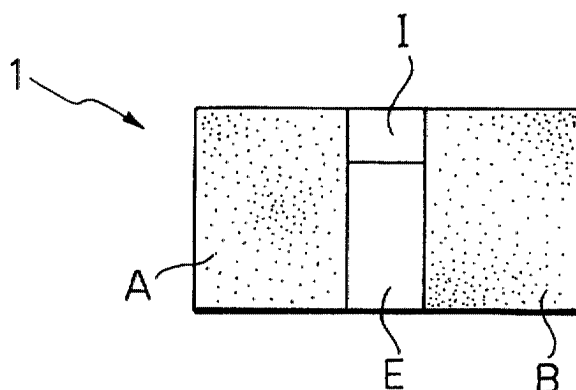
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(54) **System for combating fires, in particular for use in motor vehicles**

(57) Described herein is fire-extinguishing device consisting of powder nanoparticles of two reaction compounds (A, B) compressed within a volume of a few cubic centimetres together with an explosive microcore (E) and a priming device (I). In the preferred embodiment, the heat of the flames triggers the explosion, which causes nebulization of the powder nanoparticles from

the environment. A first phenomenon of control of the flames is due to the partial suffocation caused by the powder. A second phenomenon is due to the chemical reaction between the two reaction compounds, which subtracts heat from the flames. A third phenomenon is the removal of oxygen from the flames, due to the nanoparticles which, after explosion, expand reacting rapidly with the oxygen present in the environment.

FIG. 1



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Description

[0001] The present invention relates to the field of systems for controlling fires. The known systems so far used in combating fires adopt mainly three different strategies: heat reduction, suffocation, and chemical reactions.

[0002] The purpose of the present invention is to provide a new system for controlling fires, which acts with a combination of the three mechanisms mentioned above.

[0003] With a view to achieving the above purpose, the subject of the present invention is a system for controlling fires, characterized in that it comprises the following elements:

nanoparticles of at least two different reaction compounds, compacted by pressure or arranged in layers within a contained volume;
an explosive microcore; and
a device for sparking off the explosive microcore, in which:

the aforesaid reaction compounds are able to react with oxygen so as to reduce the oxygen present in the environment;

the aforesaid reaction compounds are able to react together absorbing heat from the flames; and

the priming device is able to initiate the explosion of the explosive microcore as a result of the heat deriving from the contact with the flames, or else as a result of a sharp variation in acceleration (impact), or again as a result of a combination of these phenomena.

[0004] In the present description and in the ensuing claims, by the term "nanoparticles" is meant particles having dimensions of the order of nanometres. According to the invention, the nanoparticles of the two different reaction compounds are compressed separately or mixed within a very contained volume of just a few cubic centimetres. The heat initiates the explosion of the explosive, which nebulizes the powder nanoparticles in the environment. The first phenomenon of control of the flames is due to the partial suffocation caused by the powder. The second phenomenon is due to the chemical reaction between the powders of compounds chosen, the contact between which causes reactions that subtract heat from the flames. For example, one compound may be sodium bicarbonate, and the other may be potassium bicarbonate. The third effect is the removal of oxygen from the flames. Following upon nebulization due to the explosion, the nanoparticles expand, reacting rapidly with the oxygen present in the environment.

[0005] Further characteristics and advantages of the present invention will emerge from the ensuing description,

with reference to the attached drawings, provided purely by way of non-limiting example, in which:

- Figure 1 is a schematic view at an enlarged scale of a device according to the invention;
- Figure 2 illustrates a variant of Figure 1;
- Figure 3 is a view, at a more enlarged scale, of a detail of Figure 2; and
- Figures 4, 5, and 6 illustrate three further variants.

[0006] With reference to Figure 1, the device according to the invention, designated as a whole by 1, comprises nanoparticles of two compounds A and B which are compacted into a small cube (a few cubic centimetres in volume) in two separate compartments and which surround an explosive microcore E. A priming device I initiates the explosion if it comes into contact with the flame, or else following upon impact.

[0007] Figure 2 illustrates a more efficient variant in which the nanoparticles of the two compounds A and B are deposited in alternate monolayers (see Figure 3) with the purpose of favouring nebulization, the endothermic reaction between the two compounds, and maximization of the number of nanoparticles, which, oxidizing, capture oxygen in the environment.

[0008] The explosive microcore preferably consists of a product with a high rate of explosion, whilst, in order to favour progressive nebulization and maximum expansion of the nanoparticles, the device has explosive branches with a product that has a lower rate of explosion.

[0009] The device for priming the explosive microcore may be of the heat type, of the electric-spark type, or again of the mechanical type, and the control may involve various degrees of complexity and may include a microprocessor, a micro-accelerometer, or a microgyroscope, constructed using microtechnology techniques. In one applicational version, the devices according to the invention, which have a shape and size typical of cubes of sugar, may be cast onto the flames by an electromechanical fire-extinguishing nozzle similar to a gun, or more simply may be dropped by gravity into the danger area.

[0010] According to a further possible variant, in addition to the two compounds A and B, a third compound of nanoparticles may be used, which reacts with the oxygen. This solution is particularly suitable for the embodiment illustrated in Figure 2, where the alternate layers comprise a succession of three layers of compounds A, B and C.

[0011] The nanoparticles may be prepared in the form of a paste that can be applied by silk-screen printing, and are then deposited in successive layers by silk-screen printing.

[0012] According to a further embodiment (Figure 4), the two compounds of nanoparticles are deposited on the two sides A, B of a film substrate 2 (Figure 4 illustrates the two opposite faces of the film 2) wound as

illustrated in Figure 5. In this case, preferably the priming device is represented by two layers 3 deposited on the two opposite faces of the cylinder constituted by the wound film substrate (Figure 6).

[0013] The device according to the invention can be used also in the automobile sector, for example for extinguishing a fire resulting from the explosion of the vehicle fuel tank. However, the application of the invention is general. Devices according to the invention may be used, for instance, as fire-extinguishing means in the kitchens of dwellings and in public buildings as an alternative to foam-generating means. The invention is also suited for being used as a fire-extinguishing means in forestry, more precisely when associated to mechanical or electromechanical ballistic means which are able to shoot a number of devices into the danger area.

[0014] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary widely with respect to what is described and illustrated herein purely by way of example, without thereby departing from the scope of the present invention.

Claims

1. A system for controlling fires, **characterized in that** it comprises:

nanoparticles of at least two reaction compounds (A, B), which are compacted by pressure or arranged in layers within a contained volume;
an explosive microcore; and
a priming device for initiating the explosive microcore,
in which:

the aforesaid reaction compounds are able to react with oxygen so as to reduce the oxygen present in the environment;
the aforesaid reaction compounds are able to react together absorbing heat from the flames; and
the priming device is able to initiate the explosion of the explosive microcore as a result of the heat generated by contact with the flames, and/or as a result of a sharp variation in acceleration (impact), or again as a result of a combination of these phenomena.

2. The system according to Claim 1, in which the layers of the compounds are deposited as alternate molecular layers, for example using Langmuir-Blodgett techniques.

3. The system according to Claim 1, in which the ex-

plosive microcore consists of an explosive with a high rate of explosion, and in which the branches consist of a layer of explosive material having a lower rate of explosion.

4. The system according to Claim 1, in which the explosive microcore is deposited in an intermediate layer between the multilayers of the nanoparticle compounds.

5. The system according to Claim 1, in which the nanoparticles are prepared in the form of a paste that can be applied by silk-screen printing, and are then deposited in successive layers by silk-screen printing.

6. The system according to Claim 1, in which the priming device is designed to initiate following upon the signal from a heat or flame sensor, for example of the pyro-electric, thermoelectric, or thermocouple type, or else of the gas or electronic type.

7. The system according to Claim 1, in which both the explosive and the nanoparticles compounds are deposited on one side or on both sides of a windable film substrate.

8. The system according to Claim 7, in which the aforesaid film substrate is wound into small cylinders, on the side surfaces of which there is deposited the layer of primer.

9. The system according to Claim 1, in which the nanoparticles act on the flames by suffocation, by subtraction of oxygen, and by reaction with absorption of heat.

10. The system according to Claim 1, **characterized in that**, in addition to the aforesaid reaction compounds (A, B) which react together subtracting heat as a result of the explosion, a third nanoparticle compound (C) is provided, which is able to react with oxygen.

11. The system according to Claim 1, **characterized in that** the priming device consists of an explosive with a low rate of explosion, which is initiated by contact with a flame or by a spark.

12. The system according to Claim 11, **characterized in that** the spark for initiation of the flame is caused by an electric mechanism.

13. The system according to Claim 1, usable for extinguishing a fire resulting from the explosion of the fuel tank of a motor vehicle.

14. The system according to Claim 1, used as a fire-

extinguishing means in the kitchens of dwellings.

15. The system according to Claim 1, used as a fire-extinguishing means in public premises, and in particular in hotels, as an alternative to foam-generating means. 5
16. The system according to Claim 1, usable as a fire-extinguishing means in forestry, preferably in association with mechanical or electromechanical ballistic means which are able to shoot a number of devices into the danger area. 10

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FIG. 1

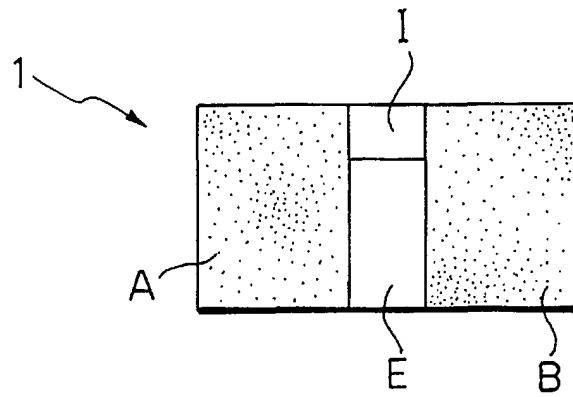


FIG. 2

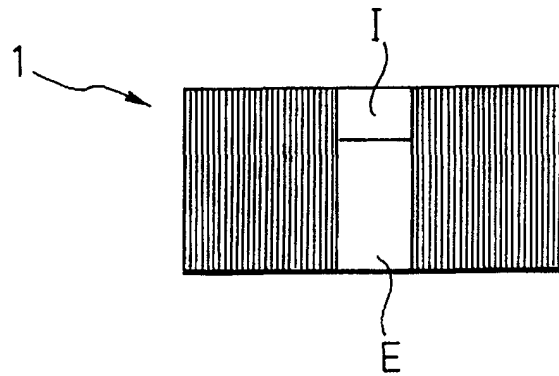


FIG. 3

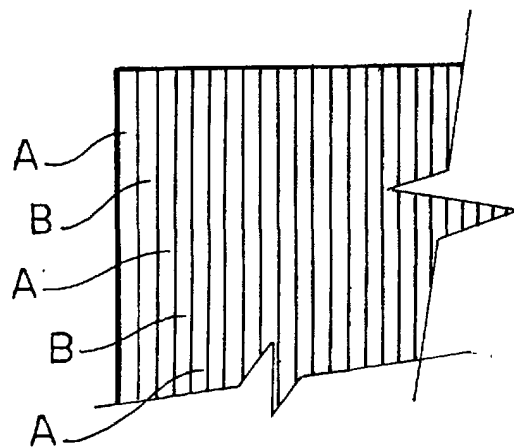


FIG. 4

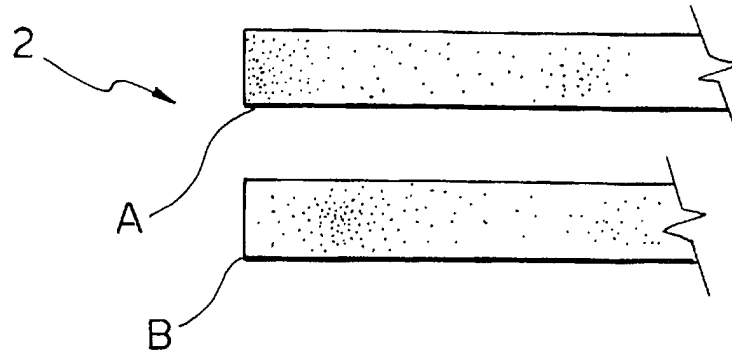


FIG. 5

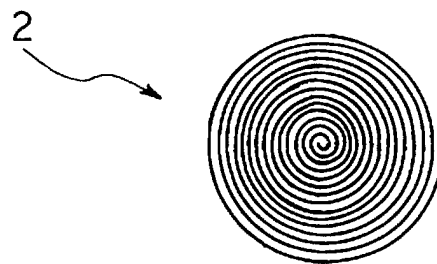


FIG. 6

