EXPLOSIVE-DISSEMINATOR PACKAGE

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ABSTRACT
A package for the explosive-dissemination of material, e.g., chaff, is described herein as an embodiment of the invention. This package includes a safe-and-arm mechanism which prevents detonation of the explosive during transport and loading, and in the event of malfunction during the dispensing of the package. During normal operation, the fuze assembly must be unlocked and transferred to a first position for the initiation of the primer and pyrotechnical delay. Once the package clears the package dispenser, the fuze assembly is moved to a second position where the pyrotechnical delay becomes aligned with the detonator for the explosive.

11 Claims, 6 Drawing Figures
EXPLOSIVE-DISSEMINATOR PACKAGE

BACKGROUND OF THE INVENTION

The present invention relates to a package which is designed to be ejected or dispensed from aircraft and the like and which thereafter explosively disseminates the material contained within the package, and more particularly to a safety mechanism incorporated into such a package which prevents undesired detonation of the explosive during transport, loading, and prior to full ejection of the package from the aircraft.

It is quite common to disseminate material by the use of explosives in order to effect wide dispersion of such material in a brief interval of time. These materials, by way of example, include such things as chemical and biological agents, and explosively driven fragments of which chaff is one further example. When the explosive is also contained within the package, it is apparent that care must be exercised during transport and loading of such packages, as well as during their ejection in order to prevent injury or death to personnel or damage or destruction of the aircraft. For example, in the event that the package-ejecting or -dispensing mechanism is actuated but fails to eject the package, a subsequent explosion can damage or possibly cause loss of the aircraft. It is obvious, therefore, that some form of safety apparatus must be employed in conjunction with the detonation mechanism to guard against such eventualities.

SUMMARY OF THE INVENTION

Briefly, the present invention includes a package of the type adapted to be ejected from a dispenser and thereafter to explosively disseminate the material contained therein. The package includes a safe-and-arm mechanism having a firing pin, a fuze assembly, a spring normally urging said fuze assembly toward said firing pin for initiation thereby, and during operation said fuze assembly assuming a first operational position against said firing pin, a detonator positioned on said package at a point normally removed from said fuze assembly, said fuze assembly designed to become aligned with said detonator following initiation of said fuze assembly, said fuze assembly thereby assuming a second operational position, means for restraining transfer of said fuze assembly from said first operational position to said second operational position, and means for releasing said restraining means, operable when said package is clear of said detonator mechanism, whereby said fuze assembly can transfer to said second operational position and initiate said detonator.

Accordingly, it is an object of the present invention to provide an improved package for the explosive dissemination of material which incorporates a safety mechanism for preventing inadvertent detonation of the explosive during either the transport, loading or dispensing operation.

Another object of the present invention is to provide such an improved package in which the safety mechanism includes the safe, arm and fuze assembly which must function in a prescribed sequence of operation in order to effect detonation of the explosive in the package.

Still another object of the present invention is the provision of the aforesaid safety mechanism which employs pneumatic and mechanical operation in a predetermined sequence to effect detonation.

Still another object of the present invention is to provide an improved package which is formed of two main subassemblies, permitting separate and economical manufacture and subsequent assembly into a unitary package.

Other and further objects and advantages of the present invention will become apparent from the following description of the preferred embodiment in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the improved package of the present invention;
FIG. 2 is a plan view in cross-section of the safe, arm, and fuzing subassembly;
FIG. 3 is a front elevation view of the subassembly of FIG. 2;
FIG. 4 is a side elevation view taken along line 4—4 of FIG. 3;
FIG. 5 is a rear elevation view of the container subassembly; and
FIG. 6 is a side elevation view taken along line 6—6 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to the drawings, FIG. 1 shows in perspective a view of the unitary package 10 constructed in accordance with the present invention. Atop the enclosed body of the package is the safety mechanism, indicated generally by the numeral 12, which is discussed hereinafter in the description of FIG. 2—4. Within the interior of package 10 is a detonator (FIG. 3) and the material to be disseminated (FIG. 6), neither of which are shown in this view. The front face 14 of the package is provided with a continuous fracture groove 16 adjacent to its periphery which is designed to fail by the pressure of the explosion, as hereinafter described, to permit the material to be expelled from the package and thereby disseminated.

The package 10 is formed of two main subassemblies, one of which includes the safety mechanism and detonator and is depicted in FIGS. 2—4. This subassembly is generally of an inverted-L construction having a thickened top portion 20 and a thinner side portion 22 which forms the back plate of the package 10, when assembled. This subassembly is formed with recessed surfaces 24 and 26 for mating with the other main subassembly.

The safety mechanism 12 includes a baseplate 28 which can be a continuation of top 20, as shown, or a separate element attached thereto, if desired. With reference to FIG. 3, base plate 28 is formed with a greater thickness on its left end than on its right. An enlarged housing 30 rises upwardly from plate 28. A bore 32 is provided in the rear of this housing. The right side of housing 30 narrows into an elongated, cylindrical neck portion 34; and both the housing 30 and is neck 34 are provided with a continuous bore 36 which terminates at closed end 38 of the neck extension.

A bore-ride 40 is positioned for longitudinal movement in bore 32. Bore-ride 40 is a rod having on its right end a cut-away portion to form flat face 42. At the left end of bore-ride 40 there is a crank pin 44 which is secured within an appropriately formed hole. Crank pin extends over the back plate 22. In operation, crank pin 44 serves as a lever which rotates the bore-
rider 40 within bore 32 to change the orientation of face 42 from a horizontal attitude, as shown, to a vertical position for reasons explained hereinafter.

A bracket 46 is mounted on bore-rider 40, and this bracket 46 has a firing pin 48 attached at its outer end. The length of the bracket 46 is such that firing pin 48 is positioned at approximately the center line of bore 36. Bracket 46 is loosely mounted onto bore-rider 40 so as not to interfere with its rotation when crank pin 44 is turned. Bore 32 is also provided with a spring seat 50 which seats a bore-rider spring 50. Spring 50 is compressed and abuts the right side of bracket 46 which is in turn in abutting engagement with crank pin 44. The purpose of bore-rider spring 50 is to eject bore-rider 40 including firing pin 48 from bore 32 under certain conditions as later explained.

Arming crank pin 44 is in abutting engagement with a crank lock pin 52 vertically mounted in base plate 28. Lock pin 52 restrains lateral movement of crank pin 44 and thereby prevents ejection of bore-rider 40 unless crank pin 44 is rotated towards the vertical sufficiently to clear the top of lock pin 52. As shown in FIGS. 2 and 3, the bore-rider 40 is on a line with the left side of the package 10.

A deton slide 56 is slidingly mounted on the neck portion 34 of housing 30. Slide 56 is of an elongated cylindrical construction, hollow on its interior, and closed at its lower end which is depicted on the right in FIGS. 3 and 4. Within deton slide 56, a spring 58 is positioned between its lower end and a spring seat 60, formed on end 38 of neck 34. Spring 58 normally urges deton slide 56 to the right, the movement of the slide being limited by stop pin 62 mounted vertically in base plate 28. The left end of slide 56 terminates in an annular face 64, a part of which abuts right end 66 of bore-rider 40. This abutting relationship between bore-rider 40 and slide 56 restrains movement of slide 56 inward or to the left over the surface of neck 34. On the inside surface of deton slide 56 there is formed an annular groove 66.

A fuze assembly is slidingly positioned within bore 36. This assembly includes a slide 70 of a generally cup-shaped construction. The interior of slide 70 includes a primer 72 and a pyrotechnic composition 74 which functions as a pyrotechnic delay train. A hole 76 is provided through the underside of slide 70 and opens into its interior. This hole 76 is also filled with the pyrotechnic composition 74. A heavy, compressed spring 78 is positioned between the end 38 of the neck portion 34 and the base 80 of slide 70.

Slide 70 is normally locked against movement within bore 36, under the urging of spring 78, by virtue of a conventional ball-lock mechanism. This includes a pair of balls 82 spaced diametrically across the slide 70 and resting in small notches formed therein. These balls also reside partly in two small aligned holes 84 formed through the wall of neck 34. As shown, the balls are restrained against outward motion by the inside surface of deton slide 56 to complete the locking function.

A stop pin 86 is vertically mounted at the left end of baseplate 28. Pin 86 is horizontally positioned forward of the outer end of bracket 46 so as not to interfere with the ejection of bore-rider 40 during operation. A detonator 88 is positioned in a hole formed in base plate 28, the top of the detonator being flush with the top of this base plate. The vertical center line of detonator 88 intersects at a right angle with the horizontal center line of bore 36. Pin 86 is positioned with respect to detonator 88 so that during operation it stops slide 70 with the hole 76 vertically aligned with detonator 88.

Connected to and running from the detonator 88 is a conventional detonating cord 90. As shown, cord 90 is wound on back plate 22 in a serpentine fashion about two raised, semicircular members 92 and 94. Cord 90 terminates at a raised button 96 where it is held by wedging it into button slot 98. Structural rigidity is given to the members 20 and 22 by a pair of brackets 100 and 102. In arranging cord 90 it is preferred, although not essential, that the cord be positioned against bracket 100 for support.

The other of the two major subassemblies which form the package 10 is essentially a container for the material to be disseminated and is shown in FIGS. 5 and 6. This subassembly comprises a case whose front face 14, two sides and bottom form the same surfaces of the package 10. The rear face includes a cover 106 designed to slide in place and be retained by the overhang 108 projecting inwardly from the two sides and the bottom of the case. The subassembly, therefore, is closed on all sides except the top. The interior of the subassembly is filled with the material to be disseminated in a loose or prepackaged form, to a level just below the top of the assembly thereby leaving exposed interior surfaces 112. The rear cover 106 has two tabs 114 which are cut along the sides and then bent inwardly to assist in retaining the material 110 within the subassembly. This arrangement also leaves a space for receiving brackets 100 and 102 (FIG. 3) during assembly of the two subassemblies.

To form the unitary package shown in FIG. 1, the subassemblies depicted in FIGS. 2 & 6 are joined together by bonding surfaces 34 and 26 (FIG. 3), respectively, to surfaces 112 and 108 (FIG. 5). The elements which protrude inwardly from back plate 22, such as members 92, 94 and 96, will press against cover 106 and cause it to be pushed in slightly. However, any compression of material 110 which might occur causes no problem as the pressure which is created is too slight to fracture groove 16. If desired, cover 106 can be formed with indentations sized and positioned to receive the projections from plate 22.

In operation, one or more of the packages 10, each of which are filled with material to be disseminated, are preferably loaded into a conventional magazine or dispenser in the upright attitude shown in FIG. 1 so that they can be ejected vertically downward. The dispenser or magazine is sized and dimensioned to receive the package 10 and to act upon it by a charge of compressed air. As depicted by the broken line 120 in FIG. 4, the package fits closely within the dispenser outline so that the compressed air can function to eject the package. As explained previously, the crank pin 44 extends over the edge of the package 10; and the purpose for this is to permit it to be tripped or rotated by striking an appropriately positioned surface of the dispenser during operation.

The operational sequence is as follows. The dispenser functions to release pressurized gas against the upper surface of the package 10 which causes the package to move vertically downward towards the dispenser ejection port (not shown). The downward motion causes the crank pin 44 to be rotated upwardly towards the vertical by contact with the dispenser body. Rotation of
crank pin 44 causes rotation of bore-rider 40 sufficiently for face 42 to clear the front surface 64 of detent slide 56. Detent slide 56 is now free to move inwardly, or to the left, on neck 34. It should be pointed out that the rotation of crank pin 44 has also been sufficient to clear the top of lock pin 52 and now bore-rider 40 can be ejected under the urging of spring 50 once the end 54 of this bore-rider clears the dispenser.

The gas pressure in the dispenser creates a greater force on the right end of detent slide 56 than it does on the smaller presented area of annular face 64; and this differential force is also sufficient to overcome detent spring 58. Detent slide moves to the left over neck 34 of the housing. As the annular groove 68 passes the plane in which the balls 82 are located, these balls are forced outward into this groove by the urging of firing spring 78. Slide 70 is thereby unlocked, and it is accelerated against bracket 46 by spring 78 causing the firing pin 48 to strike and ignite primer 72. Primer 72 in turn ignites the pyrotechnic delay 74. The fuze assembly is now at what is here termed as the first operational position.

While delay 74 is burning, the package clears the dispenser; and the bore-rider 40 is ejected from the package by the urging of spring 50 against the bracket 46. Bore-rider 40 carries with it crank pin 44 and bracket 46. Since slide 70 is no longer restrained by bracket 46, it is driven over against stop pin 86 by spring 78. Hole 76 in the bottom of slide 70 is now vertically aligned with detonator 88. The fuze assembly has now transferred to its second operational position.

The pyrotechnic 74 burns down into hole 76 and ignites detonator 88. The detonator 88 initiates detonator cord 90. The detonation pressure compresses the material 110 against the face 14 of the package, and the fracture groove 16 fails. The material 110 is expelled from the package 10 by the residual pressure of the detonation and the initial outward motion of the material, as well as any natural expansion of the compressed material; and dissemination of the material occurs.

The above described sequence of operation ensures that the package 10 must be expelled from the dispenser, and thereby the aircraft, before the detonating cord 90 can be actuated. As described, the arming crank pin 44 must first be rotated through a predetermined angle before any subsequent step can occur including ignition of primer 72 because until detent slide 56 is free to move, slide 70 is locked against movement. Assuming, however, that during the dispensing cycle the crank pin 44 is actuated and detent slide is moved sufficiently to the left to unlock balls 82 but that package 10 does not clear the dispenser and remains inside, detonating cord 90 can still not be initiated. This is seen from the fact that the bore-rider 40 cannot be ejected because its end 54 is restrained by the interior of the dispenser. Thus, bracket 46 and firing pin 48 remain in place. The primer 72 will be initiated since it will be driven against pin 48, and the pyrotechnic delay train 74 will burn; however, hole 70 cannot become aligned with detonator 88 because the fuze assembly cannot be transferred to be the second operational position, and the pyrotechnic burning cycle is interrupted when pyrotechnic delay 74 burns out. The package 10 can now be safely removed from the dispenser.

In addition to providing improved safety in operation, the present invention also assures safe handling during transport and loading. For example, if the crank pin 44 is ever inadvertently rotated sufficiently for face 42 of bore-rider 40 to clear the detent slide 56, crank pin 44 will at the same time clear the top of lock pin 52. What results is that bore-rider 40 is ejected by the action of spring 50 and carries with it the bracket 46 and firing pin 48. Even where the detent slide 56 is in some way pushed in at the same time, there is no danger of detonation of cord 90 because it takes less time for the bore-rider 40 to be ejected, once crank pin 44 clears lock pin 52, then it does for the slide 56 additionally to be then pushed in, the balls 82 unlocked, and the primer 72 to reach the first operational position. In other words, there is an inherent mechanical delay which ensures that primer 72 cannot be fired in this situation.

While the present invention has been described with respect to a particular embodiment, various changes coming within the spirit of the invention may now suggest themselves to those skilled in the art; therefore, it is not the intention to be limited to the specific embodiment shown and described or uses mentioned but instead to limit the scope of the invention only by the language of the appended claims and its equivalents.

What I claim is:

1. A package, to be dispensed from a dispenser mechanism and thereafter to explosively disseminate the material contained therein, including a safe-and-arm mechanism comprising:

a. a firing pin,
b. a fuze assembly,
c. a spring urging said fuze assembly toward said firing pin for initiation thereby, and during operation said fuze assembly assuming a first operational position in contact with said firing pin,
d. a detonator positioned on said package at a point removed from said fuze assembly, said fuze assembly designed to become aligned with said detonator following initiation of said fuze assembly, said fuze assembly thereby assuming a second operational position,
e. means for restraining transfer of said fuze assembly from said first operational position to said second operational position, and
f. means for releasing said restraining means, operable when said package is clear of said dispenser mechanism, whereby said fuze assembly can transfer to said second operational position and initiate said detonator.

2. A package as claimed in claim 1 further comprising:

a. means for releasably locking said fuze assembly in a preoperational position, said locking means designed to become unlocked during operation in response to gas pressure in the dispenser to permit said fuze assembly to transfer to said first operational position under the urging of said spring.

3. A package as claimed in claim 2 wherein said restraining means includes:

a. a mount for said firing pin, said mount positioned to be abutted by said fuze assembly in said first operational position,
b. movable means for preventing said locking means from unlocking said fuze assembly, and
c. said mount being coupled to said movable means.

4. A package as claimed in claim 3 wherein said restraining means further includes:
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7. A package as claimed in claim 6 wherein:
   a. said restraining means is mounted on said safe-and-arm mechanism for rotational movement, and
   b. said moving means is a lever connected to said restraining means to rotate the latter upon engagement with the dispenser mechanism.

8. A package as claimed in claim 7 wherein said safe-and-arm mechanism further comprises:
   a. a housing mounted on said package,
   b. said housing being provided with two bores,
   c. said restraining means being mounted in one of said bores, and
   d. said fuze assembly and spring being mounted in tandem in the other of said bores.

9. A package as claimed in claim 8 wherein said fuze assembly comprises:
   a. a hollow cylinder closed at one end and opened at the other, and having a hole adjacent its closed end,
   b. a primer positioned at the open end,
   c. a pyrotechnic composition filling the remainder of the cylinder and said hole.

10. A package as claimed in claim 9 wherein said restraining means comprises:
    a. a rod-shaped bore-rider,
    b. one end of said bore-rider being in abutting relationship with said locking means and designed to be rotated out of said abutting relationship to release said locking means; and said ejecting means comprises:
    c. a compressed spring mounted concentrically with said bore-rider and in engagement therewith to urge said bore-rider out of said one of said bores.

11. A package as claimed in claim 9 further comprising:
    a. an explosive connected to said detonator,
    b. a fracture groove on the exterior of the package designed to fail under the pressure created by explosion of the explosive to permit the material to be disseminated.

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