Serial Number 09/708,250

Filing Date 8 November 2000

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NESTED RING BASED COUNTERMASS ASSEMBLY

Origin of the Invention

Field of the Invention

The invention relates generally to countermass assemblies, and more particularly to a countermass assembly made from a stack of nested rings.

Background of the Invention

A variety of countermass materials and assemblies are known in the art. Materials include fluids and fluid-like substances and mixtures, powders, granular mixtures, flakes, prestressed and readily-fragmentizing glass, flying objects and exploding objects, just to name a few. Many of these materials are inappropriate for the development of a countermass designed to be launched from within a confined space. Fluid-based countermasses tend to have a low density thereby requiring a large volume to be affective. Fluids are also vulnerable to freezing and evaporating at the wide range of temperatures and storage typically required of a weapon. Mixtures of solids and fluids present settling problems in addition to the fluid related problems, as well as viscosity problems and poor dispersion characteristics. Powders tend to produce high side loads on the launch tube and do not flow out

of a nozzle cleanly. Other designs have problems with stability under the high acceleration forces during ejection, resulting in breakage and buckling of the countermass. Further, many materials are not suitable for dispersion due to their inherent hazardous nature (e.g., fragmentizing glass), environmental and/or health concerns.

Summary of the Invention

Accordingly, it is an object of the present invention to provide a countermass assembly.

Another object of the present invention to provide a countermass assembly that is stable prior to deployment.

Still another object of the present invention to provide a countermass assembly that exits a launch tube cleanly and completely.

Yet another object of the present invention to provide a countermass assembly that disperses safely into the environment.

Still another object of the present invention to provide a countermass assembly that is not toxic to personnel or the environment.

A further object of the present invention to provide a countermass assembly that makes efficient use of space.

Other objects and advantages of the present invention will become more obvious hereinafter in the specification and drawings.

In accordance with the present invention, a countermass assembly comprises a plurality of groups arranged axially adjacent one another to form a stack having a common longitudinal axis. Each group has a plurality of rings arranged in a nested interengagement.

Brief Description of the Drawings

FIG. 1 is a perspective view of a stack of nested ring assemblies forming a countermass assembly according to one embodiment of the present invention;

FIG. 2 is a perspective view of the countermass assembly of FIG. 1 once it has exited a launch tube;

FIG. 3 is a side view of one ring constructed as a roll of a strip material;

FIG. 4 is a perspective view of another embodiment of the present invention in which each layer of rings has a different axial length; and

FIG. 5 is an exploded side view of another embodiment of the present invention in which adjacent layers of nested rings are radially interlocked.

Detailed Description of the Invention

Referring now to the drawings, and more particularly to FIG. 1, an embodiment of a countermass assembly according to the present invention is shown and referenced generally by numeral 10. Countermass assembly 10 is a dispersible countermass that can be used in a variety of guns or other launch systems, the choice of which in no way limits the scope of the present invention.

Countermass assembly 10 is a layered stack of nested rings. More specifically, each layer of countermass assembly 10 consists of a series of individual rings 12, 14, 16 and 18 successively nested with one another. Only the top layer is visible in FIG. 1. Although four such rings are shown in each layer of the illustrated embodiment, more or fewer individual rings can be used. The diametric thickness (i.e., D_{12}, D_{14}, D_{16}, D_{18}) of each ring can be the same or different. At the

center of each layer, a disk 20 can optionally be nested with the innermost ring 18 to completely fill the available countermass space.

Rings 12, 14, 16, 18 and disk 20 are positioned in a nested relationship as shown, and are maintained in countermass assembly 10 by means of a gun barrel or launch tube (not shown). That is, the relationship between adjacent rings and ring 18/disk 20 is not a binding or press-fit relationship. Rather, the gun barrel or launch tube restrains axial and radial movement of the rings and disks until assembly 10 is ejected therefrom. In this way, when countermass assembly 10 is ejected into the surrounding environment, rings 12, 14, 16, 18 and disks 20 disperse and flutter due to their aerodynamically unstable shape as illustrated in FIG. 2.

Some or all of rings 12, 14, 16, 18 and disks 20 can be solid or can be made of a strip material that is wound similar to a roll of tape. For example, as illustrated in FIG. 3, one ring 12 is shown as being constructed of a strip 120. The outboard end 120A of strip 120 can be lightly tacked to the outermost winding of ring 12 to keep the ring configuration during assembly. When the rings (or disks 20) are constructed in this fashion, the strips will tend to unfurl as the rings and disks disperse. The unfurling of each ring and/or disk further slows their velocity as the unfurling strip material presents more surface area thereby increasing its aerodynamic instability.

Each ring and disk in countermass assembly 10 has the same axial length. However, the present invention could also be made with layers of differing axial length as illustrated by countermass assembly 100 in FIG. 4. Specifically, a first

layer of axial length L_1 consists of rings 112, 114, 116, 118 and disk 120. A second layer of similar rings/disk has an axial length L_2, and a third layer of similar rings/disk has an axial length L_3. These lengths can be selected so that the countermass disperses in an optimal fashion for a particular application. Note that the axial lengths could also successively increase, successively decrease, or be random in length depending on the application.

The present invention could also be made by radially interlocking adjacent layers of nested rings as shown in the exploded view of FIG. 5. More specifically, layers 200 and 300 are shown separated from one another along a common longitudinal axis 400. As in the previous embodiments, each layer consists of nested rings with an optional central disk. However, the axial length of each ring/disk in a layer is varied to complement an adjacent ring/disk. For example, layer 200 has rings 212, 214, 216, 218 and disk 220 at its center. Layer 300 has rings 312, 314, 316, 318 and disk 320 at its center. The lengths of rings 212, 214, 216, 218 and disk 220 are l_1, l_2, l_3, l_4 and l_5, respectively. In a complementary fashion, the lengths of rings 312, 314, 316, 318 and disk 320 are l_5, l_4, l_3, l_2 and l_1, respectively. Thus, when layers 200 and 300 are pressed into axial engagement along axis 400, layers 200 and 300 will be radially interlocked with one another.

The advantages of the present invention are numerous. The nested ring design will support a large axial load without buckling. Additionally, the circular design is optimal for supporting a tangential or hoop load when the stack is compressed axially during launch. Despite the compression-stable qualities of the stack of nested rings, they will

disperse readily upon release. Additionally, the rings can be fabricated from a wide variety of materials. The strip/roll version may provide less of a threat to bystanders. In addition, the fabrication and assembly are not complicated or sensitive to minor size or material variations.

The countermass assembly of the present invention is easily made chemically inert and non-toxic. The design lends itself to being made form a variety of materials that are insensitive to changing and/or extreme temperatures. In addition, the use of nested rings and a central disk provides a space efficient design.

Although the invention has been described relative to a specific embodiment thereof, there are numerous variations and modifications that will be readily apparent to those skilled in the art in light of the above teachings. It is therefore to be understood that

the invention may be practiced other than as specifically described.

Abstract

A countermass assembly comprises a plurality of groups of nested rings, with the groups being arranged axially adjacent one another to form a stack having a common longitudinal axis.

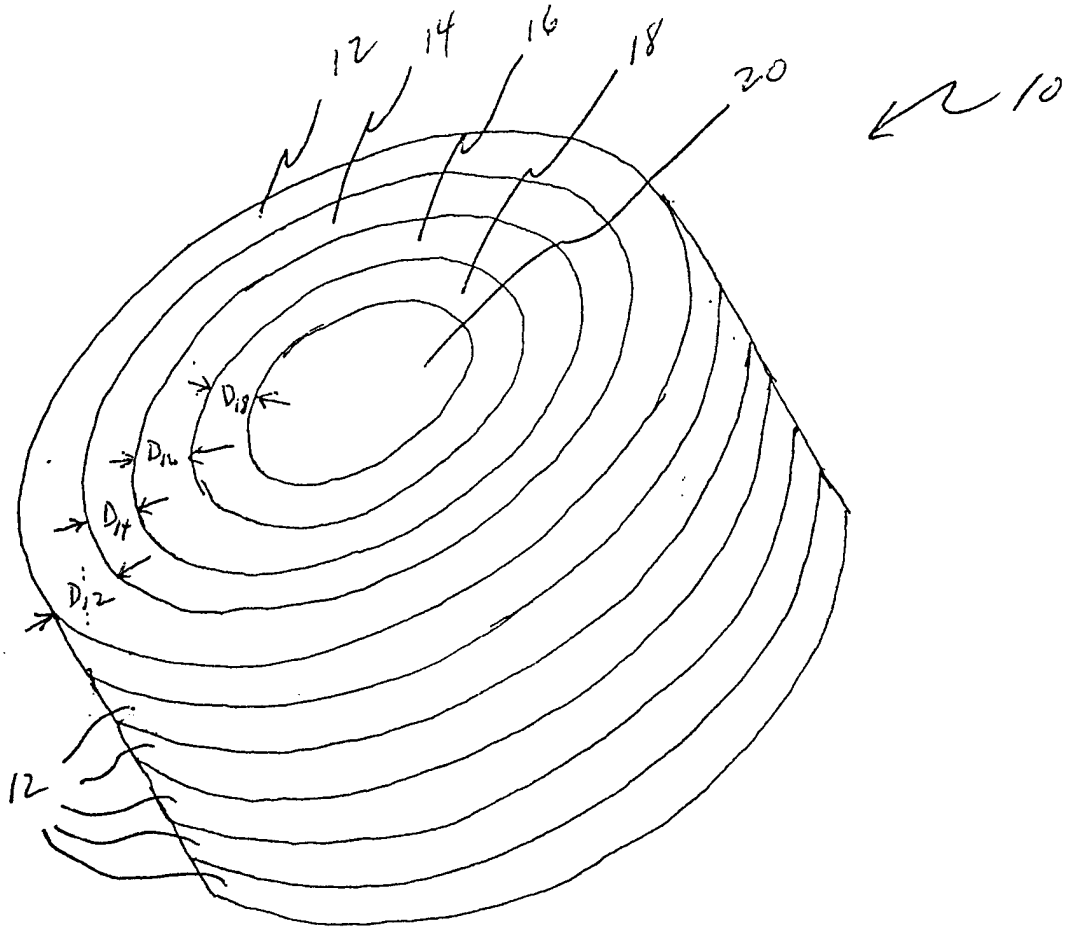

FIG. 1

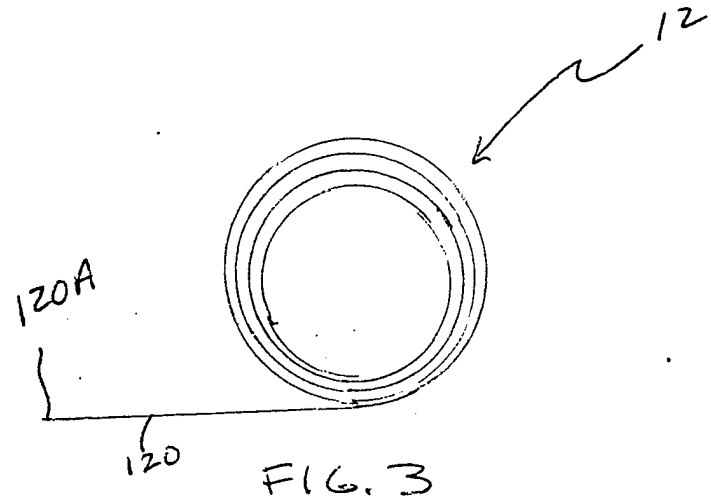

FIG. 3

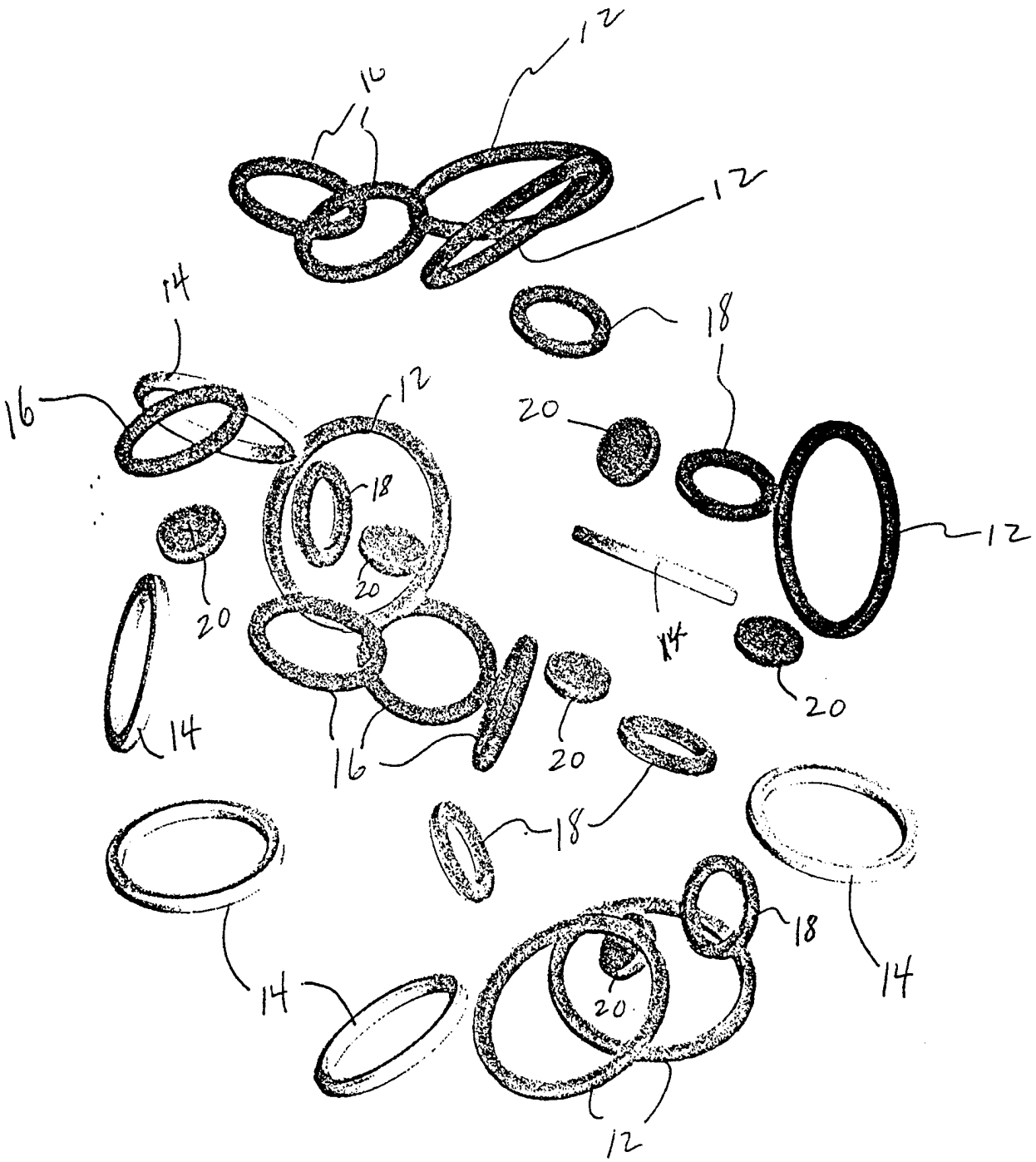

FIG. 2

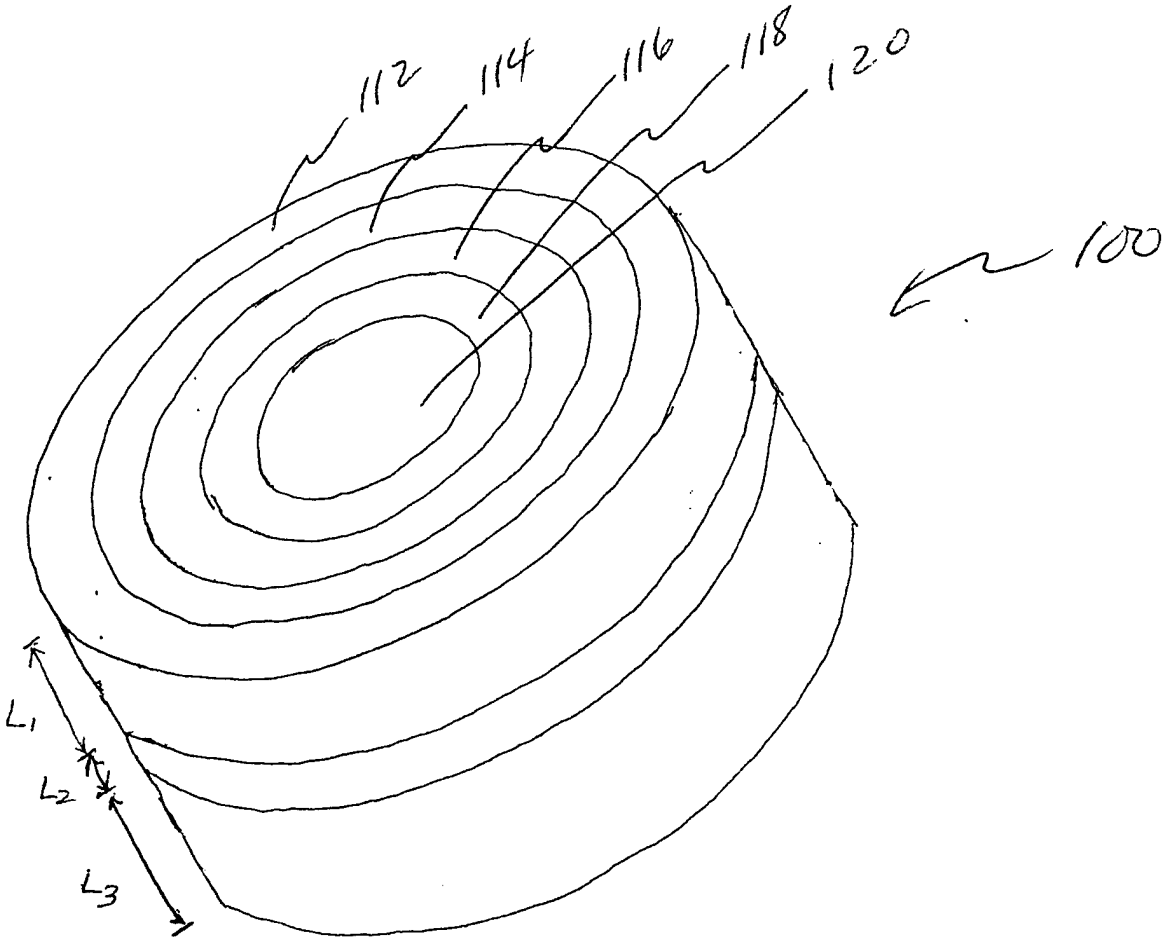

FIG. 4

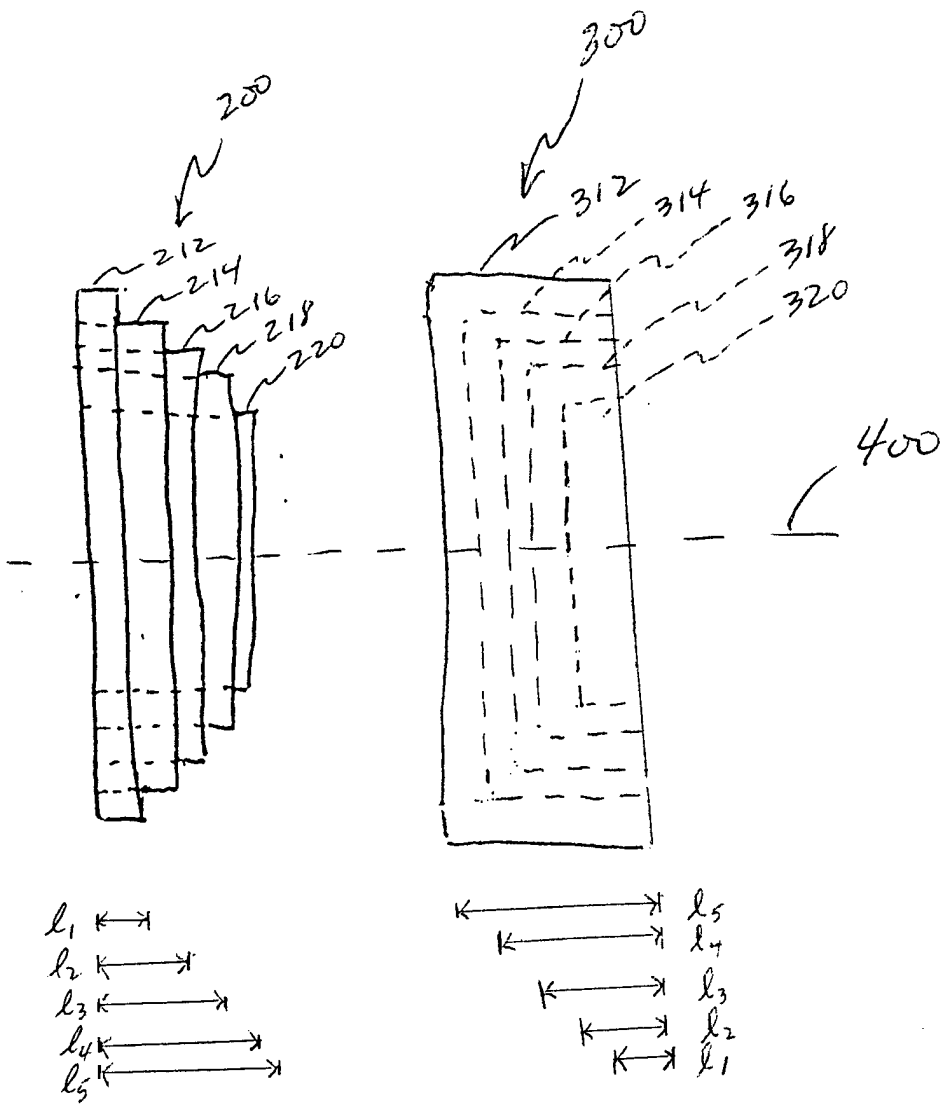
200
300
212
214
216
218
220
312
314
316
318
320
400
l_1
l_2
l_3
l_4
l_5
l_5
l_4
l_3
l_2
l_1

FIG. 5