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

(11) EP 3 094 945 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
17.10.2018 Bulletin 2018/42

(21) Application number: **14877936.6**

(22) Date of filing: **30.06.2014**

(51) Int Cl.:
F42B 8/00 *(2006.01)* ***F42B 8/12*** *(2006.01)*
F42B 12/40 *(2006.01)* ***F42B 12/50*** *(2006.01)*

(86) International application number:
PCT/US2014/044892

(87) International publication number:
WO 2015/105526 (16.07.2015 Gazette 2015/28)

(54) PAYLOAD CARRYING ARRANGEMENT FOR A NON-LETHAL PROJECTILE

NUTZLASTTRAGEANORDNUNG FÜR EIN NICHTLETALES GESCHOSS

AGENCEMENT DE SUPPORT DE CHARGE UTILE POUR PROJECTILE NON-LÉTAL

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **13.01.2014 US 201461926728 P**

(43) Date of publication of application:
23.11.2016 Bulletin 2016/47

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Description

FIELD OF THE INVENTION

[0001] The invention broadly relates to non-lethal projectiles, more specifically to payload carrying non-lethal projectiles, and even more particularly to a payload carrying non-lethal projectile arranged to disburse its payload evenly upon impact with a target.

BACKGROUND OF THE INVENTION

[0002] Non-lethal projectiles are well known in the art. For example, United States Patent No. 7,861,657, issued on January 4, 2011, discloses a non-lethal projectile comprising a deformable head arranged to absorb kinetic energy upon impact of the projectile with a target.

[0003] In addition to or as an alternative to a deformable head, non-lethal projectiles may comprise a variety of head designs some of which may be arranged to carry a payload. Such payloads may include but are not limited to malodorant, marking liquid, marking powder, pepper liquid and pepper powder. An example of a payload carrying non-lethal projectile is disclosed in United States Patent Application Publication No. 2005/0066849, which published on March 31, 2005. The device disclosed in the foregoing publication includes a nose portion formed from a frangible, rigid, polymer foam material such that the nose crushes upon impact with a target to disperse energy, thereby reducing the kinetic energy transferred to the target while simultaneously dispensing its payload, e.g., marker agents, lacrimators, irritants, inflammatory agents, odorants or inert powders.

[0004] Non-lethal projectiles known in the art suffer from a variety of drawbacks. For example, known projectile head arrangements fail to provide a controlled dispensing of a payload. Such payloads are randomly and unpredictably dispersed upon impact. Such a condition may decrease the effectiveness of the payload as it may fail to reach its desired location or desired extent of dispersion. Additionally, tradeoffs between kinetic energy dissipation and quantities and types of payloads have been required. For example, frangible powder payloads do not dissipate kinetic energy to the same extent as a viscoelastic material such as a silicone rubber polymer. Similarly, liquid payloads offer a hydro-impact effect to lessen inertia upon impacting a target.

US patent 3,865,038 discloses a deterrent ammunition including a projectile of soft elastic rupturable material, having a charge of flowable material carried in a cavity having relatively thin longitudinal rupture wall zones and thicker longitudinal strengthening zones bounding the cavity. US patent application 824,327 (US Invention Registration HI 14) discloses a practice projectile having a windshield member formed of a frangible material mounted to a body member thereby forming a chamber, the chamber holding a signal powder. The projectile includes a piston member within the chamber; upon impact of the projectile the piston member assists in fracturing the windshield member.

International patent application WO 2006/007738 A1 discloses a projectile which upon impact acts as a kinetic energy projectile and bursts at a soft front part of the projectile, releasing and spraying an active substance stored in the projectile body.

BRIEF SUMMARY OF THE INVENTION

[0005] The present invention is defined by claim 1. Within this application, the terms "resilient layer" and "resilient expander" are used synonymously; the terms "payload carrying packet" and "marker packet" are also used synonymously in this application.

In an embodiment of the non-lethal projectile of the present invention the non-lethal projectile includes a frame, a guide expander, an expander cap, a resilient layer, a marker packet and a cap. The frame includes a substantially cylindrical hollow body, a closed upper end and a through bore centrally disposed within the closed upper end and coaxially arranged with the substantially cylindrical body. The guide expander includes a cylindrical guide and a base, wherein the cylindrical guide is disposed within the bore and longitudinally displaceable therein. The expander base includes a plurality of segments, a lower protrusion and an upper protrusion, wherein the guide expander contacts the lower protrusion and each segment of the plurality of segments is connected to each adjacent segment by a weakened portion. The expander cap includes an upper surface having a plurality of offset circular planar surfaces and a through bore centrally disposed and contacting the upper protrusion of the expander base, wherein the upper surface of the expander cap contacts a lower surface of the resilient layer. The marker packet includes a hollow body having a lower surface, at least a partial opening centrally disposed, an upper surface, a volume formed by the lower surface, the at least a partial opening and the upper surface, and a payload contained within the volume. The upper surface of the marker packet includes a wall and at least one weakened portion within the wall, and the lower surface of the marker packet contacts an upper surface of the resilient layer. The cap is arranged to enclose the marker packet, the resilient expander and the expander cap, and partially enclose the expander base, wherein the payload is dispersed on or near a target upon impact by the non-lethal projectile.

[0006] In an embodiment of the non-lethal projectile of the present invention the non-lethal projectile has a frame, a guide expander, an expander cap, a resilient expander, a marker packet and a cap. The frame includes a substantially cylindrical hollow body, a closed upper end and a through bore centrally disposed within the closed upper end and coaxially arranged with the substantially cylindrical body. The guide expander includes a cylindrical guide and a base, wherein the cylindrical guide is disposed within the bore and longitudinally dis-

placeable therein. The expander base includes a plurality of segments, a lower protrusion and an upper protrusion, wherein the guide expander contacts the lower protrusion and each segment of the plurality of segments is connected to each adjacent segment by a weakened portion. The expander cap includes an upper surface having a plurality of offset circular planar surfaces and a through bore centrally disposed and contacting the upper protrusion of the expander base. The resilient expander includes a base and an extension, wherein the upper surface of the expander cap contacts a lower surface of the base. The marker packet includes a hollow body having a lower surface, a central opening, an upper surface, a volume formed by the
lower surface, the central opening and the upper surface and a payload contained within the volume, wherein the upper surface of the marker packet includes a plurality of segments, each segment of the plurality of segments is connected to each adjacent segment by a weakened portion, the extension of the resilient expander is disposed within the central opening, and the lower surface of the marker packet contacts an upper surface of the base of the resilient expander. The cap is arranged to enclose the marker packet, the resilient expander and the expander cap, and partially enclose the expander base, wherein the payload is dispersed on or near a target upon impact by the non-lethal projectile.

[0007] In an embodiment of the non-lethal projectile of the present invention a payload dispersion system for the non-lethal projectile includes a resilient layer and a marker packet having a hollow body including a lower surface, at least a partial opening centrally disposed, an upper surface, a volume formed by the lower surface, the at least a partial opening and the upper surface, and a payload contained within the volume, wherein the upper surface of the marker packet includes a wall and at least one weakened portion within the wall, and the lower surface of the marker packet contacts an upper surface of the resilient layer.

[0008] In an embodiment of the non-lethal projectile of the present invention a payload dispersion system for the non-lethal projectile includes a resilient expander having a base and an extension, and a marker packet having a hollow body including a lower surface, a central opening, an upper surface, a volume formed by the lower surface, the central opening and the upper surface and a payload contained within the volume, wherein the upper surface of the marker packet includes a plurality of segments, each segment of the plurality of segments is connected to each adjacent segment by a weakened portion, the extension of the resilient expander is disposed within the central opening, and the lower surface of the marker packet contacts an upper surface of the base of the resilient expander.

[0009] In an embodiment of the non-lethal projectile of the present invention a payload carrying packet for the non-lethal projectile includes a hollow body having a lower surface, at least a partial opening centrally disposed, an upper surface, a volume formed by the lower surface, the at least a partial opening and the upper surface and a payload contained within the volume, wherein the upper surface of the marker packet includes a wall and at least one weakened portion within the wall.

[0010] It is a general object of the present invention to provide a non-lethal projectile that maximizes the safety of its use.

[0011] It is another general object of the present invention to provide a non-lethal projectile that disperses a payload, *e.g.,* a malodorant or marking liquid, substantially evenly upon impact with a target.

[0012] It is yet another general object of the present invention to provide a non-lethal projectile that disperses impact forces substantially evenly upon impact with a target, wherein the dispersed forces are non-lethal is magnitude.

[0013] These and other objects and advantages of the present invention will be readily appreciable from the following description of preferred embodiments of the invention and from the accompanying drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The nature and mode of operation of the present invention will now be more fully described in the following detailed description of the invention taken with the accompanying drawing figures, in which:

Figure 1 is a side elevational view of an embodiment of a present invention non-lethal projectile;
Figure 2 is an enlarged cross sectional view of the encircled region 2 shown in Figure 3;
Figure 3 is a cross sectional view of the non-lethal projectile shown in Figure 1 taken generally along line 3-3 of Figure 1;
Figure 4 is a cross sectional perspective view of the non-lethal projectile shown in Figure 1 taken generally along line 4-4 of Figure 1;
Figure 5 is a side elevational view of an embodiment of an expander cap used in the embodiment of the non-lethal projectile shown in Figure 1;
Figure 6 is a cross sectional view of the expander cap shown in Figure 5 taken generally along line 6-6 of Figure 5;
Figure 7 is a top perspective view of the expander cap shown in Figure 5;
Figure 8 is a top perspective view of an embodiment of an expander base used in the embodiment of the non-lethal projectile shown in Figure 1;
Figure 9 is a top plan view of the expander base shown in Figure 8;
Figure 10 is a cross-sectional view of the expander base shown in Figure 8 taken generally along line 10-10 of Figure 9;
Figure 11 is a top perspective view of an embodiment of a projectile frame used in the embodiment of the

non-lethal projectile shown in Figure 1;
Figure 12 is a cross-sectional view of the projectile frame shown in Figure 11 taken generally along line 12-12 of Figure 11;
Figure 13 is a perspective view of an embodiment of a guide expander used in the embodiment of the non-lethal projectile shown in Figure 1;
Figure 14 is a cross-sectional view of the guide expander shown in Figure 13 taken generally along line 14-14 of Figure 13;
Figure 15 is a perspective view of an embodiment of a resilient expander used in the embodiment of the non-lethal projectile shown in Figure 1;
Figure 16 is a side elevational view of the resilient expander shown in Figure 15;
Figure 17 is a top perspective view of an embodiment of a marker packet used in the embodiment of the non-lethal projectile shown in Figure 1;
Figure 18 is a cross sectional view of the marker packet shown in Figure 17 taken generally along line 18-18 of Figure 17;
Figure 19 is a side elevational view of another embodiment of a present invention non-lethal projectile;
Figure 20 is a cross sectional perspective view of the non-lethal projectile shown in Figure 19 taken generally along line 20-20 of Figure 19;
Figure 21 is a cross sectional view of the non-lethal projectile shown in Figure 19 taken generally along line 21-21 of Figure 19;
Figure 22 is an enlarged cross sectional view of the encircled region 22 shown in Figure 21;
Figure 23 is a top perspective view of another embodiment of a marker packet used in the embodiment of the non-lethal projectile shown in Figure 19; and,
Figure 24 is a cross sectional view of the marker packet shown in Figure 23 taken generally along line 24-24 of Figure 23.

DETAILED DESCRIPTION OF THE INVENTION

[0015] At the outset, it should be appreciated that like drawing numbers on different drawing views identify identical, or functionally similar, structural elements of the invention. While the present invention is described with respect to what is presently considered to be the preferred aspects, it is to be understood that the invention as claimed is not limited to the disclosed aspects.

[0016] Furthermore, it is understood that this invention is not limited to the particular methodology, materials and modifications described and as such may, of course, vary. It is also understood that the terminology used herein is for the purpose of describing particular aspects only, and is not intended to limit the scope of the present invention, which is limited only by the appended claims.

[0017] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which these embodiments belong. As used herein, the term "average" shall be construed broadly to include any calculation in which a result datum or decision is obtained based on a plurality of input data, which can include but is not limited to, weighted averages, yes or no decisions based on rolling inputs, *etc.* Moreover, as used herein, the phrases "comprises at least one of' and "comprising at least one of' in combination with a system or element is intended to mean that the system or element includes one or more of the elements listed after the phrase. For example, a device comprising at least one of: a first element; a second element; and, a third element, is intended to be construed as any one of the following structural arrangements: a device comprising a first element; a device comprising a second element; a device comprising a third element; a device comprising a first element and a second element; a device comprising a first element and a third element; a device comprising a first element, a second element and a third element; or, a device comprising a second element and a third element. A similar interpretation is intended when the phrase "used in at least one of:" is used herein. Furthermore, as used herein, "and/or" is intended to mean a grammatical conjunction used to indicate that one or more of the elements or conditions recited may be included or occur. For example, a device comprising a first element, a second element and/or a third element, is intended to be construed as any one of the following structural arrangements: a device comprising a first element; a device comprising a second element; a device comprising a third element; a device comprising a first element and a second element; a device comprising a first element and a third element; a device comprising a first element, a second element and a third element; or, a device comprising a second element and a third element.

[0018] Although any methods, devices or materials similar or equivalent to those described herein can be used in the practice or testing of the invention, the preferred methods, devices, and materials are now described.

[0019] Non-lethal projectile **10** comprises frame **12,** guide expander **14,** expander base **16,** expander cap **18,** resilient expander **20,** marker packet **22** and cone **24.** Projectile **10** is positioned within shell **26.** Volume **28** of shell **26** acts as a combustion chamber. The propellant is ignited via a primer located inside a .38 caliber shell casing (not shown). The .38 caliber shell casing is positioned in bore **30** of shell **26.** The propellant is selected from those well known in the art and is not particularly germane to the present device. Upon ignition of the propellant, projectile **10** exits shell **26** in the direction of firing. Upon impact with a target, cone **24** collapses, expander base **16** expands outwardly, resilient expander **20** compresses and expands outwardly, and marker packet **22** ruptures, thereby dispersing the payload and collectively absorbing kinetic energy from the moving projectile **10** and decreasing its damage and/or injury to the target.

[0020] Expander base **16** is arranged to "fail" thereby absorbing kinetic energy. Expander base **16** comprises

expander base segments **64** which are connected by weakened regions **66.** Upon impact with a target, a longitudinal compression force is imparted on cone **24** and thereby on the resilient expander **20,** expander cap **18,** expander base **16** and guide expander **14.** As the foregoing elements compress, frame **12** slides relative to guide expander **14** and is pushed against expander base **16.** Frame **12** in turn causes expander base segments **64** to be pushed outwardly. Provided sufficient force is imparted on base segments **64,** weakened portions **66** fail thereby permitting further expansion of base segments **64.** The expansion of base segments **64** in combination with the failure of weakened portions **66** further absorbs kinetic energy of the moving projectile **10.** In the expanded form, expander base **16** forms a star-like structure. In addition to the foregoing absorption of energy, the inertia of projectile **10** is further dissipated by the compression of expander cap **18** against base **80** of resilient expander **20.** This action assists with the rupturing of marker packet **22,** as described in further detail *infra.* It should be appreciated that although expander base 16 and expander cap 18 are depicted as separate elements joined together, a single element can also be formed. However, due to present savings in manufacturing, the two piece arrangement is preferred.

[0021] Resilient expander **20** is formed from a flexible material, *e.g.,* silicone. As non-lethal projectile **10** impacts a target, extension **82** of resilient expander **20** is compressed in the direction depicted by uni-directional arrow **38** and thereby expands in the directions of uni-directional arrows **40.** It should be appreciated that although the expansion of extension **82** is depicted by only two arrows **40,** extension **82** is cylindrical in shape. Therefore, as extension **82** is compressed in the direction of arrow **38,** extension **82** expands outwardly in substantially all radial directions including the directions depicted by arrows **40.** Moreover, as expander cap **18** impacts base **80** of resilient expander **20,** base **80** transfers kinetic energy to base **42** of marker packet **22,** *i.e.,* transfers kinetic energy in the direction of uni-directional arrows **44.**

[0022] Resilient expander **20** assists in the dispersion of payload **46** from marker packet **22** on the target. Expander **20** also absorbs inertia, *i.e.,* kinetic energy, creates a fixture for marker packet **22** and acts as a safety barrier preventing components below resilient expander **20** from impacting a target directly. In flight, marker packet **22** is stabilized in cone **24** of projectile **10** by resilient expander **20.** During impact, extension **82** expands outwardly into inner surface **48** of marker packet **22** and base **80** of expander **20** compresses against base **42** of marker packet **22,** collectively creating a higher pressure vessel thereby dispersing payload **46** in a desirable pattern. To ensure the plastic components of projectile **10** will not penetrate the target, *e.g.,* guide expander **14,** expander base **16,** and expander cap **18,** base **80** acts as a safety barrier blocking the plastic components from moving forward upon impact. The elasticity of resilient expander **20** also absorbs some inertia from projectile **10** making it less likely to injure a target.

[0023] In an embodiment, marker packet **22** is a partial toroid shaped component formed from a material such as polyethylene. Marker packet **22** acts as a pressure vessel when a target is hit. High pressure that develops upon impact in combination with segments **50** allow for proper outward dispersion of payload **46** onto the target. In other words, a compressive force is applied to the impacting surface of packet **22,** a compressive force is applied to base **42** by base **80** of expander **20,** and a compressive force is applied to surface **48** by extension **82,** collectively pushing inwardly on payload **46.** This collective force creates a higher pressure within packet **22** thereby providing the means to effectively disperse payload **46** on a target. Segments **50** are defined and separated by etched or weakened portions **52** in the top portion of marker packet **22.** In short, upon reaching a sufficient pressure, weakened portions **52** fail or open thereby permitting dispersion of payload **46.** The foregoing arrangement of marker packet **22** also facilitates the dispersion of its kinetic energy over a larger surface area creating a projectile less likely to cause injury to a target.

[0024] In addition to the above described payloads that may be carried by the present invention non-lethal projectile, the payload may also include a tagging and/or marking agent, as well as an infrared liquid or powder. Tagging agents, such as forensic marking agents, provide greater capability for the present projectile, e.g., tagging a party prior to fleeing a scene for later identification and arrest. Thus, for example, a participant of a riot may be impacted with a present projectile carrying a forensic marking agent and even if that participant leaves the scene of the riot prior to arrest, law enforcement agents can later identify that person as a participant due to the presence of the marking agent. Such marking agents can effectively code a person, object, *etc.,* for later identification. Forensic marking agents can be configured with unique formulas so that the later identification can provide information related to where the person was tagged or who tagged the person, *i.e.,* each law enforcement agent could have a unique marking agent which will be undetectable by the person being tagged. Moreover, not only does the foregoing marking agent tag a person's clothing, but the marking agent also propagates to skin and unexposed clothing so that if a person removes the clothing that was actually impacted by the present invention projectile, the marking agents are still detectable later in time. An example of a forensic marking liquid is the SMARTWATER® product offered by SmartWater CSI LLC of Fort Lauderdale, Florida and SmartWater Technology Ltd. of London, England.

[0025] Other embodiments of the present invention non-lethal projectile have also been developed. Non-lethal projectile **110** comprises frame **112,** guide expander **114,** expander base **116,** expander cap **118,** resilient layer **120,** marker packet **122** and cone **124.** Projectile **110** is positioned within shell **126.** Volume **128** of shell **126** acts as a combustion chamber. The nature of firing pro-

jectile **110** is substantially the same as the firing of projectile **10** described above. However, upon impact with a target, cone **124** collapses, expander base **116** expands outwardly, resilient layer **120** compresses surface **142** of marker packet **122,** and marker packet **122** ruptures, thereby dispersing the payload and collectively absorbing kinetic energy from the moving projectile **110** and decreasing its damage and/or injury to the target.

[0026] Similar to the embodiment described above, expander base **116** is arranged to "fail" thereby absorbing kinetic energy. Upon impact with a target, a longitudinal compression force is imparted on cone **124** and thereby on the resilient layer **120,** expander cap **118,** expander base **116** and guide expander **114.** As the foregoing elements compress, frame **112** slides relative to guide expander **114** and is pushed against expander base **116.** Frame **112** in turn causes expander base **116** to fail, pushing the segments forming base **116** outwardly, thereby absorbing kinetic energy of the moving projectile **110.** In the expanded form, expander base **116** forms a star-like structure. In addition to the foregoing absorption of energy, the inertia of projectile **110** is further dissipated by the compression of expander cap **118** against resilient layer **120.** This action assists with the rupturing of marker packet **122,** as described in further detail *infra.*

[0027] Resilient layer **120** is formed from a flexible material, *e.g.,* silicone. As non-lethal projectile **110** impacts a target, resilient layer **120** is compressed against seal layer **142** of marker packet **122.** Moreover, as expander cap **118** impacts resilient layer **120,** expander cap **118** transfers kinetic energy to seal layer **142** of marker packet **122.**

[0028] Resilient layer **120** assists in the dispersion of payload **146** from marker packet **122** on the target, layer **120** also absorbs inertia, *i.e.,* kinetic energy, fills the gap between cap **118** and layer **142** and acts as a safety barrier preventing components below resilient layer **120** from impacting a target directly. During impact, layer **120** compresses against sealing layer **142** creating a higher pressure vessel thereby dispersing payload **146** in a desirable pattern. To ensure the plastic components of projectile **110** will not penetrate the target, *e.g.,* guide expander **114,** expander base **116,** and expander cap **118,** layer **120** also acts as a safety barrier blocking the plastic components from moving forward upon impact. The elasticity of layer **120** also absorbs some inertia from projectile **110** making it less likely to injure a target.

[0029] In an embodiment, marker packet **122** is a partial toroid shaped component comprising wall **150** formed from a material such as high density polyethylene (HDPE). Marker packet **122** further comprises sealing layer **142.** Layer **142** is secured to the base of wall **150** by any means known in the art, *e.g.,* induction sealing, and is formed from a material that is compatible with payload **146** so that layer **142** does not deteriorate prior to use, *e.g.,* during storage of the projectile. For example, layer **142** may be formed from ExpressWeb EFS 174 manufactured by Glenroy Inc. of Menomonee Falls, Wisconsin. Suitable sealing layers may include but are not limited to materials including at least one of: polyester; low density polyethylene; aluminum foil; and, linear low density polyethylene. It should be appreciated that layer **142** may also be formed as a multi-layer composite including some or all of the aforementioned materials. Marker packet **122** acts as a pressure vessel when a target is hit. High pressure that develops upon impact in combination with wall **150** allows for proper outward dispersion of payload **146** onto the target. In other words, a compressive force is applied to the impacting surface of packet **122,** a compressive force is applied to sealing layer **142** by resilient layer **120,** collectively pushing inwardly on payload **146.** This collective force creates a higher pressure within packet **122** thereby providing the means to effectively disperse payload **146** on a target. Wall **150** is defined and separated by etched or weakened portions **152** in the top portion of marker packet **122.** In short, weakened portions **152** cause a controlled failure mode of marker packet **122** when pressurized by impact, *i.e.,* wall **150** fails along the length of each weakened portions **152.** The foregoing arrangement of marker packet **122** facilitates the dispersion of its kinetic energy over a larger surface area creating a projectile less likely to cause injury to a target.

[0030] In addition to the foregoing, marker packet **122** comprises inner surface **148.** In this embodiment, inner surface **148** does not form a complete through hole in marker packet **122.** As can be best understood in view of Figure 24, the base of opening **190** does not contact sealing layer **142.** Thus, gap **192** is formed between inner surface **148** and sealing layer **142.** The gap may be larger or smaller than depicted in the figures, or alternatively, no gap may be present. It is believed that the size of gap **192** also contributes to the nature of the dispersion of payload **146** during impact with a target. Embodiments falling within the scope of the claimed invention include full through holes, *e.g.,* marker packet **22,** and partial through holes, *e.g.,* marker packet **122.** Moreover, it is contemplated that no opening may be included, and that those embodiments will form a domed structure devoid of indentations or openings in the middle of the marker packet,

[0031] The present embodiments provide non-lethal projectiles that outperform alternate designs. For example, the present invention was compared against three alternate designs for viscous criterion (VC) and impact force. The foregoing tests used various impact velocities to measure impact force, dynamic deflection and impact velocity to quantify the performance of each design. The present embodiments provided lower impact force and lower viscous criterion than each other tested design.

[0032] The impact of the present invention non-lethal projectile on a target creates two impacts of inertia on the target. The present invention causes a dispersion of inertia on the target. Upon impact, the present projectile provides an initial dispersion of inertia on the target, and subsequently as the frame and in turn the guide expander

pushes into the expander base, a second dispersion of inertia on the target occurs. Furthermore, the size of the cone of the present invention causes a wide area dispersion of force on a target which spreads kinetic energy to more nerve endings thereby causing more pain compliance while decreasing injury due to lack of penetration.

[0033] Thus, it is seen that the objects of the present invention are efficiently obtained, although modifications and changes to the invention should be readily apparent to those having ordinary skill in the art, which modifications are intended to be within the scope of the invention as disclosed in the appended claims.

Reference No. Listing:

[0034]

10 - non-lethal projectile
12 - frame
14 - guide expander
16 - expander base
18 - expander cap
20 - resilient expander
22 - marker packet
24 - cone
26 - shell
28 - volume
30 - bore
38 - uni-directional arrow
40 - uni-directional arrow
42 - base
44 - uni-directional arrow
46 - payload
48 - inner surface
50 - segment
52 - weakened portion
54 - hollow frame body
56 - upper end cap
58 - through bore
60 - guide expander base
62 - cylindrical guide
64 - expander base segment
66 - weakened portion
68 - upper protrusion
70 - lower protrusion
72 - upper surface
74 - lower surface
76 - circular planar surface
78 - through bore
80 - base
82 - extension
84 - upper surface
86 - lower surface
110 - non-lethal projectile
112 - frame
114 - guide expander
116 - expander base
118 - expander cap
120 - resilient layer
122 - marker packet
124 - cone
126 - shell
128 - volume
130 - bore
142 - sealing layer
146 - payload
148 - inner surface
150 - wall
152 - weakened portion
190 - opening
192 - gap

Claims

1. A non-lethal projectile (10, 110) comprising:

a frame (12, 112) comprising a substantially cylindrical hollow body (54), **characterized by**
a closed upper end and a through bore (58) centrally disposed within the closed upper end and coaxially arranged with the substantially cylindrical hollow body (54);
a guide expander (14, 114) comprising a cylindrical guide (62) and a base (60), wherein the cylindrical guide (62) is disposed within the through bore (58) and longitudinally displaceable therein;
an expander base (16, 116) comprising a plurality of segments (64), a lower protrusion (70) and an upper protrusion (68), wherein the guide expander (14, 114) contacts the lower protrusion (70) and each segment (64) of the plurality of segments (64) is connected to each adjacent segment by a weakened portion (66);
an expander cap (18, 118) comprising an upper surface (72) comprising a plurality of offset circular planar surfaces (76) and a through bore (78) centrally disposed and contacting the upper protrusion (68) of the expander base (16, 116);
a payload dispersion system comprising a resilient layer (20, 120) and a payload carrying packet (22, 122) comprising a hollow body comprising a lower surface, an upper surface, a volume formed by the lower surface and the upper surface, and a payload (46, 146) contained within the volume, wherein the upper surface of the payload carrying packet (22, 122) comprises a wall and at least one weakened portion (52, 152) within the wall, the lower surface of the payload carrying packet (22, 122) contacts an upper surface (84) of the resilient layer (20, 120), the upper surface (72) of the expander cap (18, 118) contacts a lower surface (86) of the resilient layer (20, 120) of the payload dispersion system; and,

a cap arranged to enclose the payload carrying packet (22, 122), the resilient layer (20,120) and the expander cap (18, 118), and partially enclose the expander base (16, 116), wherein the payload (46, 146) is dispersed on or near a target upon impact by the non-lethal projectile (10, 110).

2. The non-lethal projectile (10, 110) of claim 1, wherein the hollow body of the payload carrying packet (22, 122) further comprises at least a partial opening centrally disposed, and the volume is formed by the lower surface, the at least a partial opening, and the upper surface.

3. The non-lethal projectile (10) of claim 2, wherein the at least a partial opening in the payload carrying packet (22) comprises a through hole.

4. The non-lethal projectile (10, 110) of one of the claims 1 to 3, wherein the wall of the upper surface of the payload carrying packet (22, 122) comprises a plurality of wall segments (50), and each of the plurality of wall segments (50) is connected to each adjacent wall segment (50) by a weakened portion (52).

5. The non-lethal projectile (10, 110) of one of the claims 1 to 4, wherein the wall is formed from a thermoplastic material.

6. The non-lethal projectile (10, 110) of claim 5, wherein the thermoplastic is a high density polyethylene.

7. The non-lethal projectile (10, 110) of one of the claims 1 to 6, wherein the lower surface is formed from a multi-layer composition.

8. The non-lethal projectile (10, 110) of claim 7 wherein the multi-layer composition comprises at least of: polyester; low density polyethylene; aluminum foil; and, linear low density polyethylene.

9. The non-lethal projectile (10) of one of the claims 1 to 8, wherein the payload carrying packet (22) comprises at least a through hole centrally disposed, and the volume is formed by the lower surface, the through hole, and the upper surface, the resilient layer (20) further comprises a base (80) and an extension (82), and the extension (82) of the resilient layer (20) is disposed within the through hole.

10. The non-lethal projectile (10) of one of the claims 1 to 9, wherein the resilient layer (20) of the payload dispersion system further comprises a base (80) and an extension (82), wherein the upper surface (72) of the expander cap (18) contacts a lower surface (86) of the base (80).

Patentansprüche

1. Ein nichtletales Projektil (10, 110), umfassend:

einen Rahmen (12, 112), der einen im Wesentlichen zylindrischen Hohlkörper (54) umfasst,
gekennzeichnet durch
ein geschlossenes oberes Ende und eine Durchgangsbohrung (58), die zentral im geschlossenen oberen Ende angeordnet und koaxial mit dem im Wesentlichen zylindrischen Hohlkörper (54) angeordnet ist;
einen Führungs-Expander (14, 114), umfassend eine zylindrische Führung (62) und eine Basis (60), wobei die zylindrische Führung (62) in der Durchgangsbohrung (58) angeordnet und darin in Längsrichtung verschiebbar ist;
eine Expander-Basis (16, 116), umfassend eine Vielzahl an Segmenten (64), einen unteren Überstand (70) und einen oberen Überstand (68), wobei der Führungs-Expander (14, 114) den unteren Überstand (70) kontaktiert und jedes Segment (64) der Vielzahl an Segmenten (64) über einen verdünnten Abschnitt (66) mit dem jeweils angrenzenden Segment verbunden ist;
eine Expander-Kappe (18, 118), umfassend eine obere Oberfläche (72), die wiederum eine Vielzahl an versetzten, runden, ebenen Oberflächen (76) und eine zentral angebrachte Durchgangsbohrung (78) aufweist und den oberen Überstand (68) der Expander-Basis (16, 116) kontaktiert;
ein System zur Verteilung der Nutzlast, umfassend eine elastische Schicht (20, 120) und ein Paket zum Tragen der Nutzlast (22, 122), welches wiederum einen Hohlkörper mit einer unteren Oberfläche, einer oberen Oberfläche, ein Volumen, das aus der unteren Oberfläche und der oberen Oberfläche gebildet ist, sowie eine Nutzlast (46, 146), die im Volumen enthalten ist, umfasst, wobei die obere Oberfläche des Pakets zum Tragen der Nutzlast (22, 122) eine Wand und mindestens einen verdünnten Abschnitt (52, 152) in der Wand umfasst, die untere Oberfläche des Paktes zum Tragen der Nutzlast (22, 122) eine obere Oberfläche (84) der elastischen Schicht (20, 120) kontaktiert und die obere Oberfläche (72) der Expander-Kappe (18,118) eine untere Oberfläche (86) der elastischen Schicht (20, 120) des Systems zur Verteilung der Nutzlast kontaktiert; und,
eine Kappe, die so angeordnet ist, dass sie das Paket zum Tragen der Nutzlast (22, 122), die elastische Schicht (20, 120) sowie die Expander-Kappe (18, 118) einschließt und die Expander-Basis (16, 116) teilweise einschließt, wobei die Nutzlast (46, 146) bei Einschlag des nicht-

letalen Projektils (10, 110) auf das oder in die Nähe eines Ziels abgegeben wird.

2. Das nichtletale Projektil (10, 110) gemäß Anspruch 1, wobei der Hohlkörper des Pakets zum Tragen der Nutzlast (22, 122) zudem eine zentral angeordnete, zumindest teilweise Öffnung aufweist und das Volumen aus der unteren Oberfläche, der zumindest teilweisen Öffnung und der oberen Oberfläche gebildet ist.

3. Das nichtletale Projektil (1) gemäß Anspruch 2, wobei die zumindest teilweise Öffnung im Paket zum Tragen der Nutzlast (22) ein Durchgangsloch aufweist.

4. Das nichtletale Projektil (10, 110) gemäß einem der Ansprüche 1 bis 3, wobei die Wand der oberen Oberfläche des Pakets zum Tragen der Nutzlast (22, 122) eine Vielzahl an Wandsegmenten (50) aufweist und jedes dieser Segmente der Vielzahl an Wandsegmenten (50) über einen verdünnten Abschnitt (52) mit einem angrenzenden Wandsegment (50) verbunden ist.

5. Das nichtletale Projektil (10, 110) gemäß einem der Ansprüche 1 bis 4, wobei die Wand aus einem thermoplastischen Werkstoff gebildet ist.

6. Das nichtletale Projektil (10, 110) gemäß Anspruch 5, wobei der thermoplastische Werkstoff ein hochdichtes Polyethylen ist.

7. Das nichtletale Projekt (10, 110) gemäß einem der Ansprüche 1 bis 6, wobei die untere Oberfläche aus einem mehrschichtigen Aufbau gebildet ist.

8. Das nichtletale Projektil (10, 110) gemäß Anspruch 7, wobei der mehrschichtige Aufbau mindestens Folgendes umfasst: Polyester; Polyethylen niederer Dichte; Aluminiumfolie; und lineares Polyethylen niederer Dichte.

9. Das nichtletale Projektil (10) gemäß einem der Ansprüche 1 bis 8, wobei das Paket zum Tragen der Nutzlast (22) mindestens ein zentral angebrachtes Durchgangsloch aufweist, und das Volumen von der unteren Oberfläche, dem Durchgangsloch und der oberen Oberfläche gebildet ist, wobei die elastische Schicht (20) ferner eine Basis (80) und eine Erweiterung (82) aufweist und diese Erweiterung (82) der elastischen Schicht (20) im Durchgangsloch angeordnet ist.

10. Das nichtletale Projektil (10) gemäß einem der Ansprüche 1 bis 9, wobei die elastische Schicht (20) des Systems für die Verteilung der Traglast ferner eine Basis (80) und eine Erweiterung (82) umfasst, wobei die obere Oberfläche (72) der Expander-Kappe (18) eine untere Oberfläche (86) der Basis (80) kontaktiert.

Revendications

1. Projectile non-létal (10, 110) comprenant :

un cadre (12, 112) comprenant un corps creux sensiblement cylindrique (54), **caractérisé par** une extrémité supérieure fermée et un alésage traversant (58) disposé au centre dans l'extrémité supérieure fermée et agencé coaxialement avec le corps creux sensiblement cylindrique (54) ;
un élargisseur de guide (14, 114) comprenant un guide cylindrique (62) et une base (60), dans lequel le guide cylindrique (62) est disposé au sein de l'alésage traversant (58) et déplaçable longitudinalement à l'intérieur de celui-ci ;
une base d'élargisseur (16, 116) comprenant une pluralité de segments (64), une protubérance inférieure (70) et une protubérance supérieure (68), dans lequel l'élargisseur de guide (14, 114) vient en contact avec la protubérance inférieure (70) et chaque segment (64) de la pluralité de segments (64) est raccordé à chaque segment adjacent par une portion de moindre résistance (66) ;
un capuchon d'élargisseur (18, 118) comprenant une surface supérieure (72) comprenant une pluralité de surfaces planes circulaires décalées (76) et un alésage traversant (78) disposé au centre et venant en contact avec la protubérance supérieure (68) de la base d'élargisseur (16, 116) ;
un système de dispersion de charge utile comprenant une couche résiliente (20, 120) et un paquet porteur de charge utile (22, 122) comprenant un corps creux comprenant une surface inférieure, une surface supérieure, un volume formé par la surface inférieure et la surface supérieure, et une charge utile (46, 146) contenue au sein du volume, dans lequel la surface supérieure du paquet porteur de charge utile (22, 122) comprend une paroi et au moins une portion de moindre résistance (52, 152) au sein de la paroi, la surface inférieure du paquet porteur de charge utile (22, 122) vient en contact avec une surface supérieure (84) de la couche résiliente (20, 120), la surface supérieure (72) du capuchon d'élargisseur (18, 118) vient en contact avec une surface inférieure (86) de la couche résiliente (20, 120) du système de dispersion de charge utile ; et,
un capuchon agencé pour renfermer le paquet porteur de charge utile (22, 122), la couche ré-

siliente (20, 120) et le capuchon d'élargisseur (18, 118), et renfermer partiellement la base d'élargisseur (16, 116), dans lequel la charge utile (46, 146) est dispersée sur ou près d'une cible lors d'un impact par le projectile non-létal (10, 110).

2. Projectile non-létal (10, 110) selon la revendication 1, dans lequel le corps creux du paquet porteur de charge utile (22, 122) comprend en outre au moins une ouverture partielle disposée au centre, et le volume est formé par la surface inférieure, l'au moins une ouverture partielle et la surface supérieure.

3. Projectile non-létal (10) selon la revendication 2, dans lequel l'au moins une ouverture partielle dans le paquet porteur de charge utile (22) comprend un trou traversant.

4. Projectile non-létal (10, 110) selon l'une des revendications 1 à 3, dans lequel la paroi de la surface supérieure du paquet porteur de charge utile (22, 122) comprend une pluralité de segments de paroi (50), et chacun de la pluralité de segments de paroi (50) est raccordé à chaque segment de paroi (50) adjacent par une portion de moindre résistance (52).

5. Projectile non-létal (10, 110) selon l'une des revendications 1 à 4, dans lequel la paroi est formée en un matériau thermoplastique.

6. Projectile non-létal (10, 110) selon la revendication 5, dans lequel le thermoplastique est un polyéthylène haute densité.

7. Projectile non-létal (10, 110) selon l'une des revendications 1 à 6, dans lequel la surface inférieure est formée en une composition multicouche.

8. Projectile non-létal (10, 110) selon la revendication 7, dans lequel la composition multicouche comprend au moins l'un parmi : un polyester ; un polyéthylène basse densité ; une feuille d'aluminium ; et, un polyéthylène basse densité linéaire.

9. Projectile non-létal (10) selon l'une des revendications 1 à 8, dans lequel le paquet porteur de charge utile (22) comprend au moins un trou traversant disposé au centre, et le volume est formé par la surface inférieure, le trou traversant et la surface supérieure, la couche résiliente (20) comprend en outre une base (80) et une extension (82), et l'extension (82) de la couche résiliente (20) est disposée au sein du trou traversant.

10. Projectile non-létal (10) selon l'une des revendications 1 à 9, dans lequel la couche résiliente (20) du système de dispersion de charge utile comprend en outre une base (80) et une extension (82), dans lequel la surface supérieure (72) du capuchon d'élargisseur (18) vient en contact avec une surface inférieure (86) de la base (80).

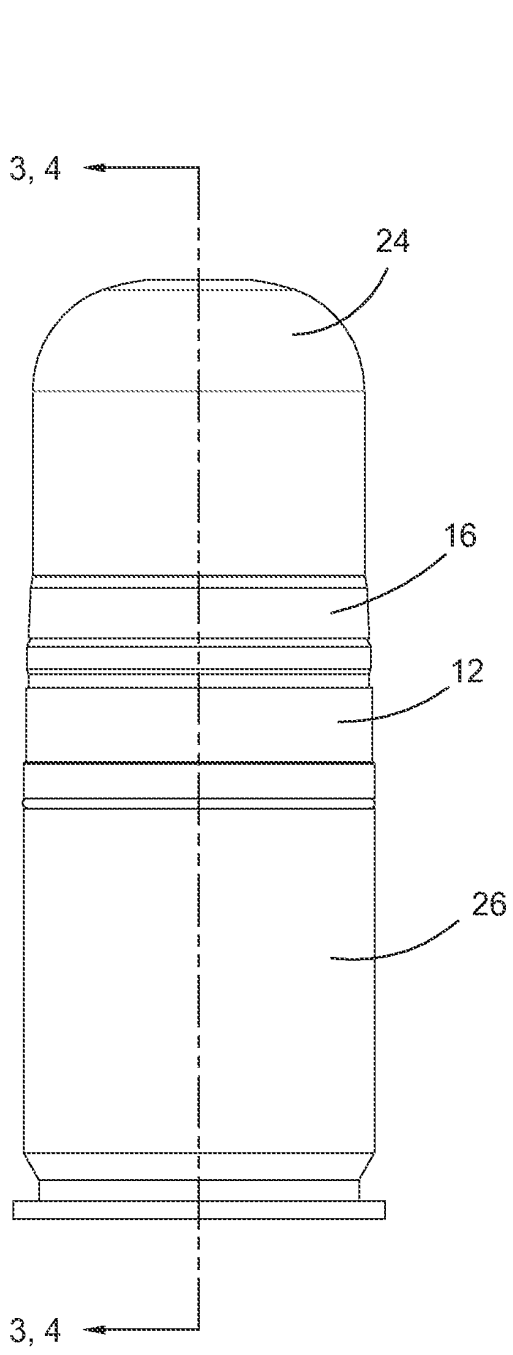

Fig. 1

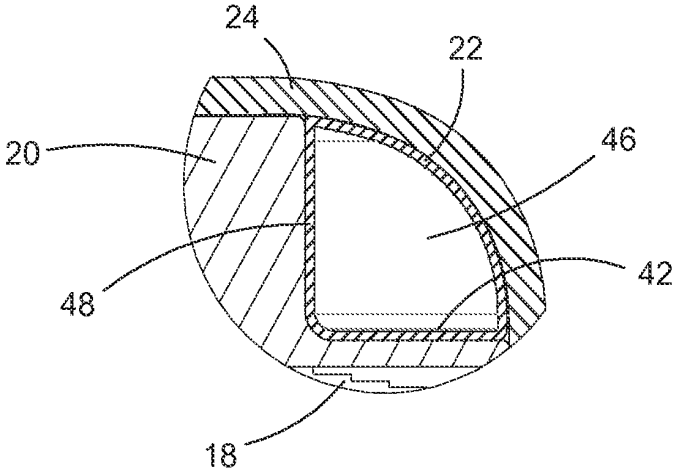

Fig. 2

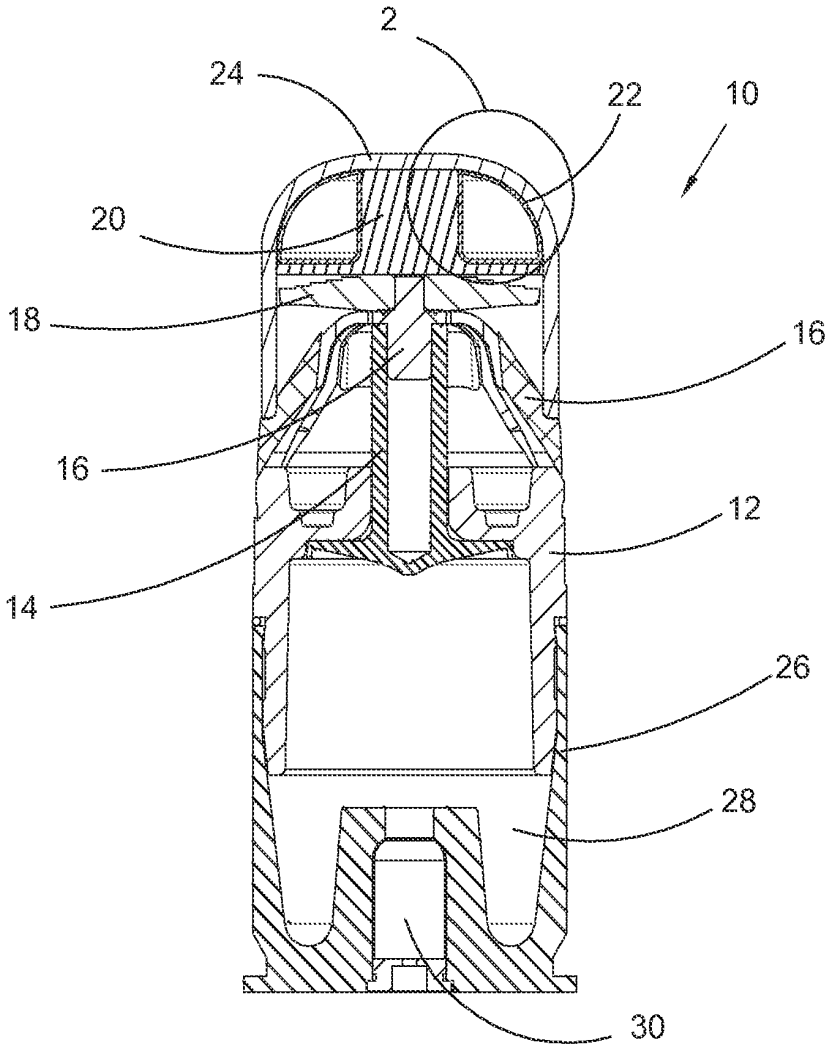

Fig. 3

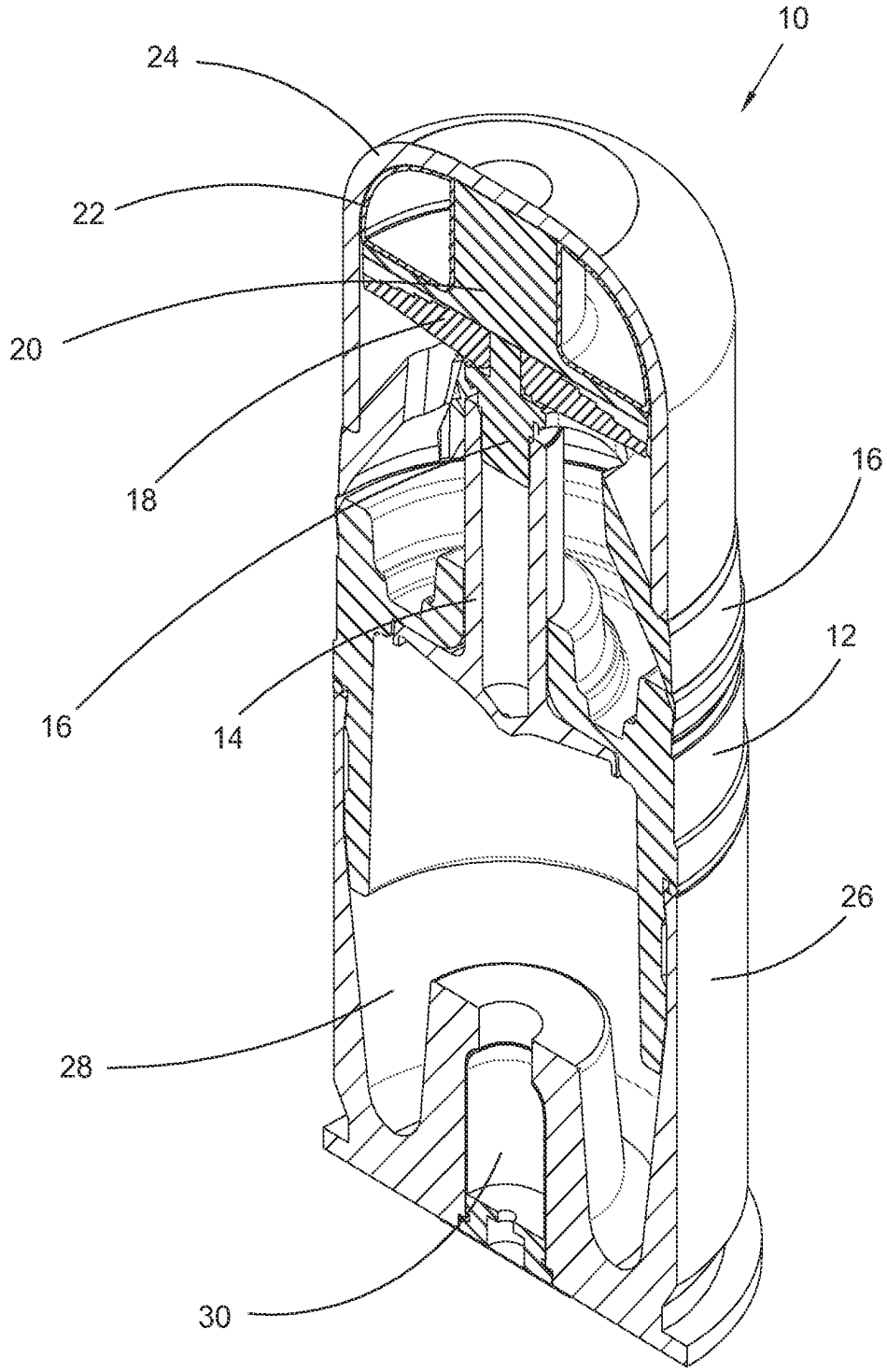

Fig. 4

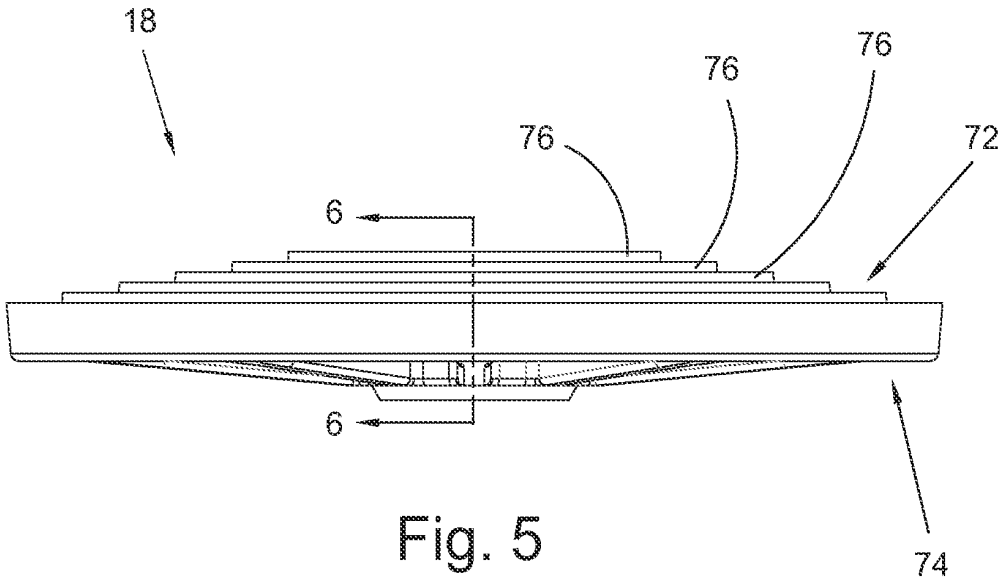

Fig. 5

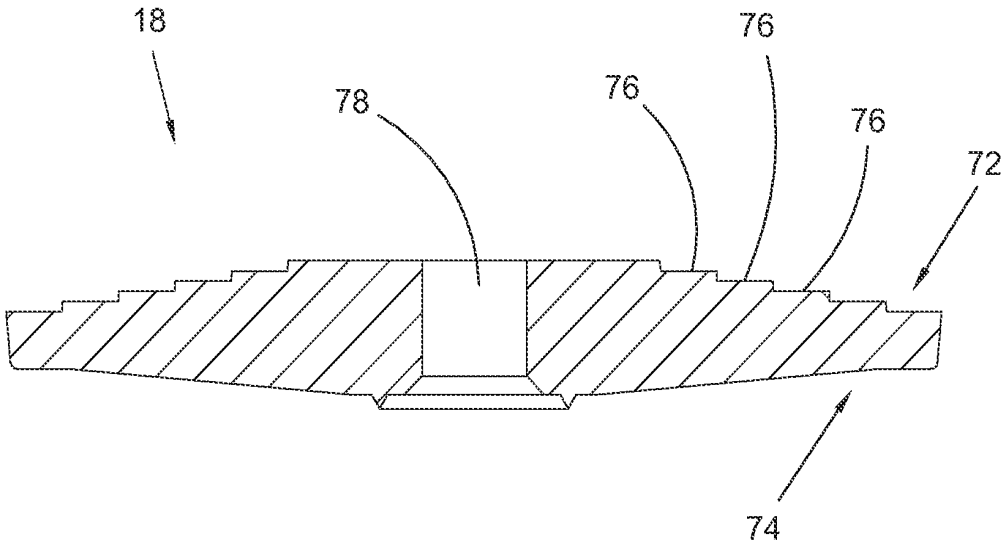

Fig. 6

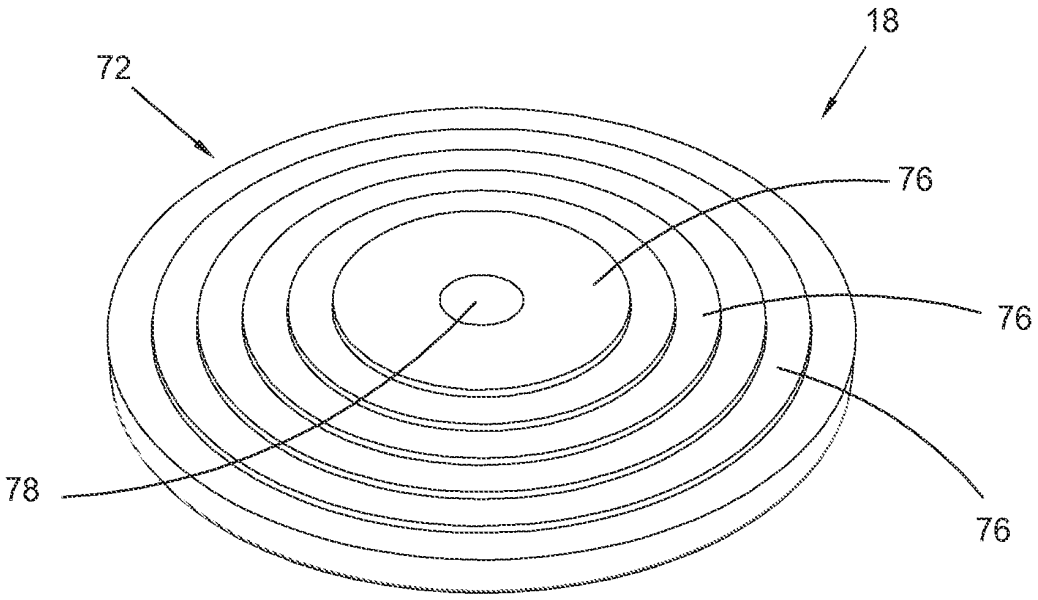

Fig. 7

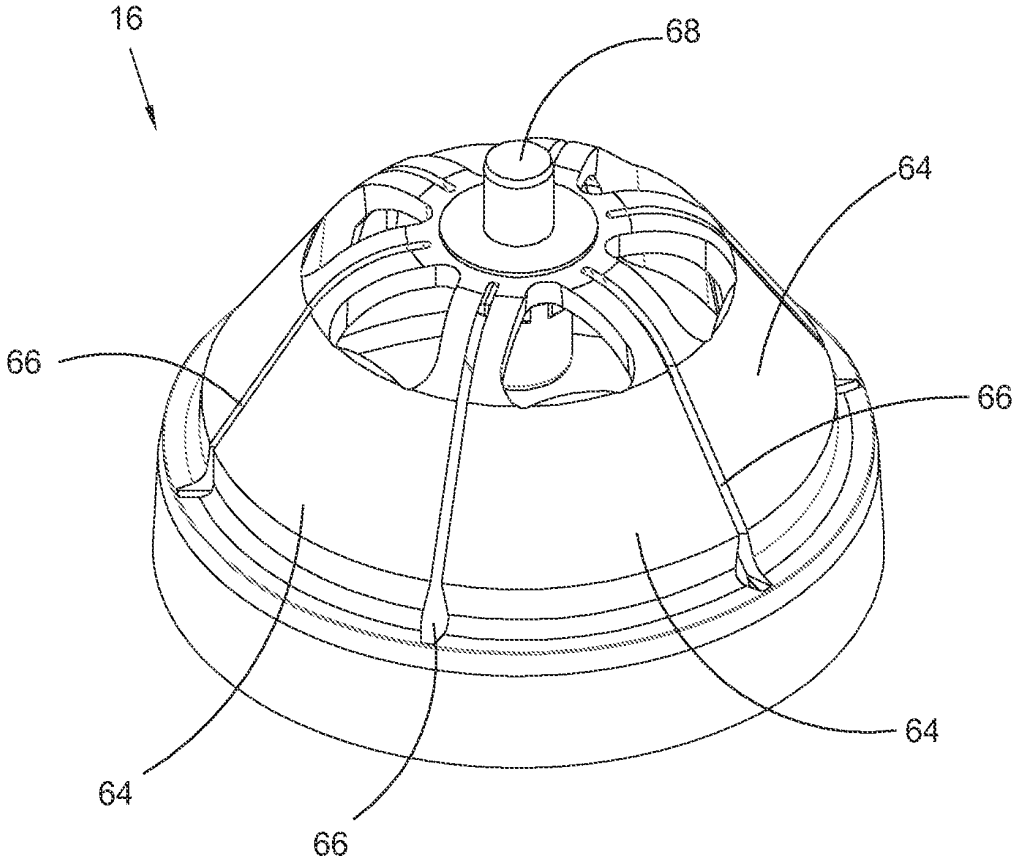

Fig. 8

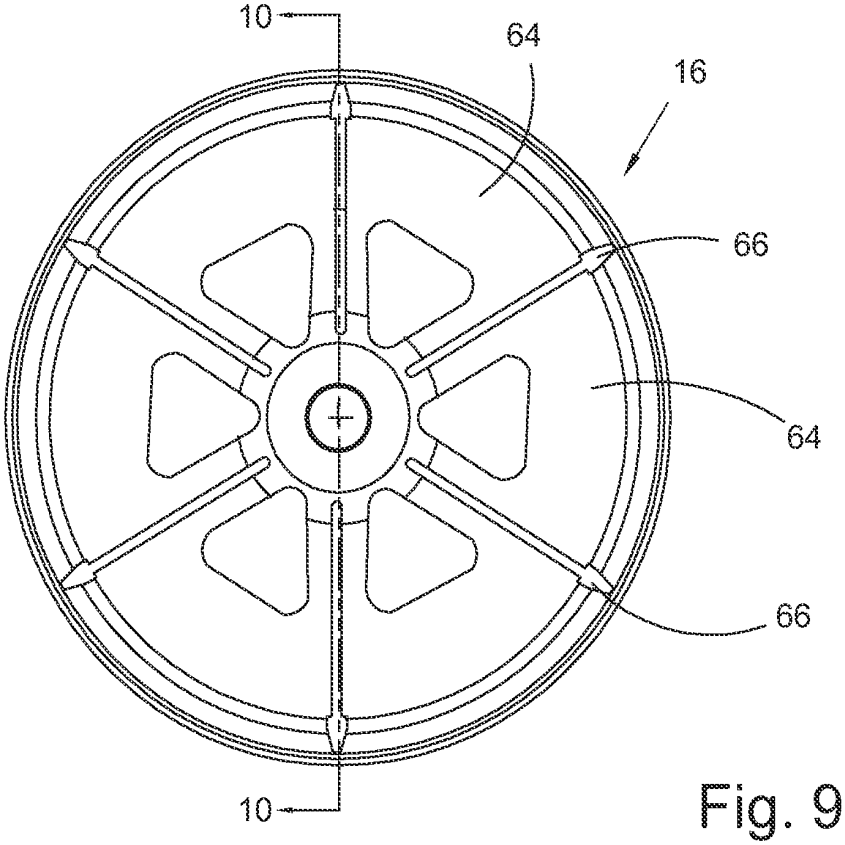

Fig. 9

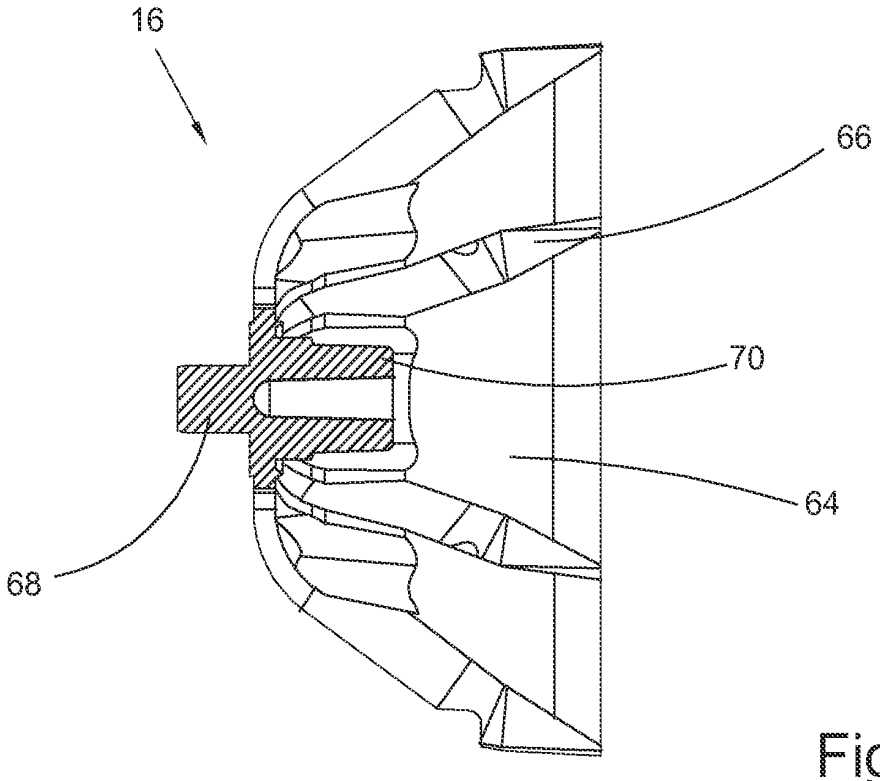

Fig. 10

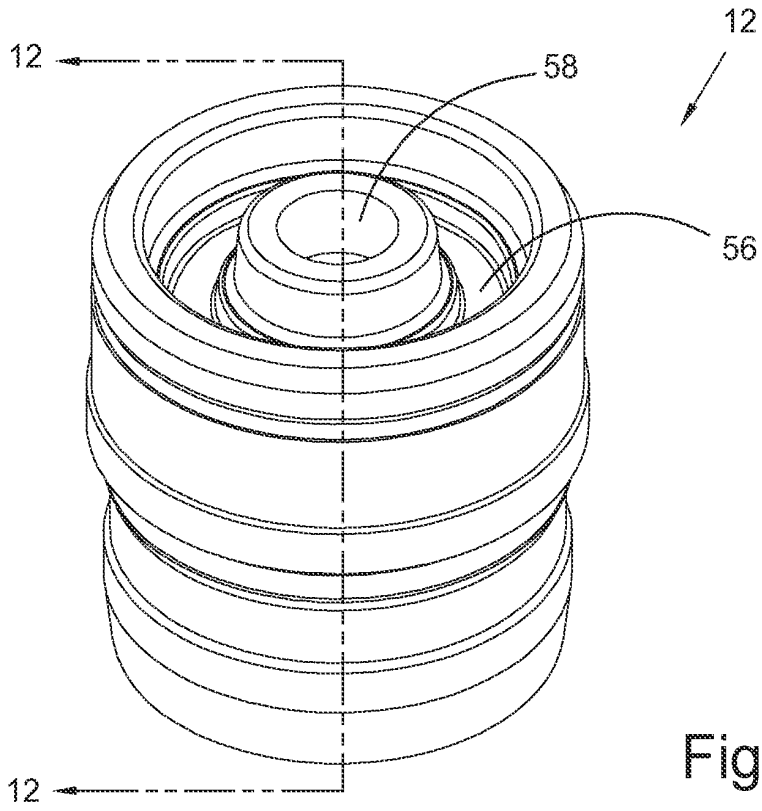

Fig. 11

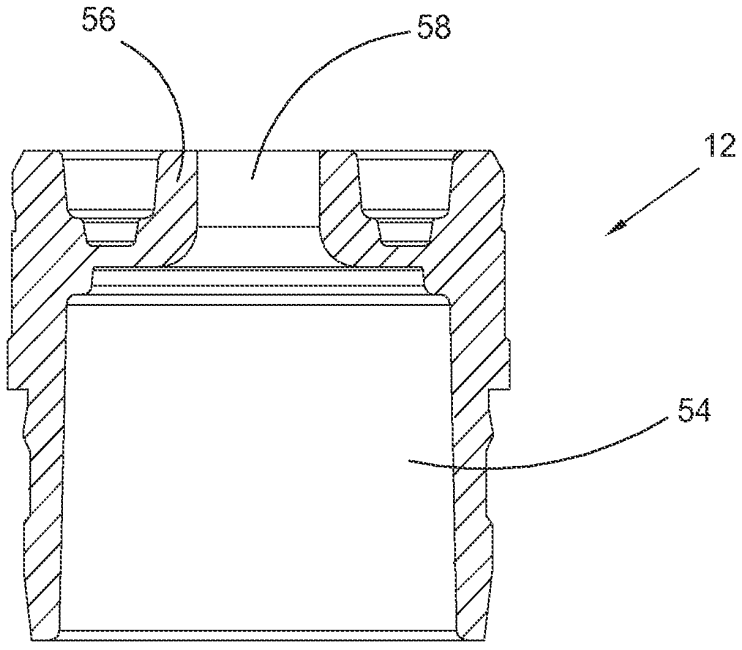

Fig. 12

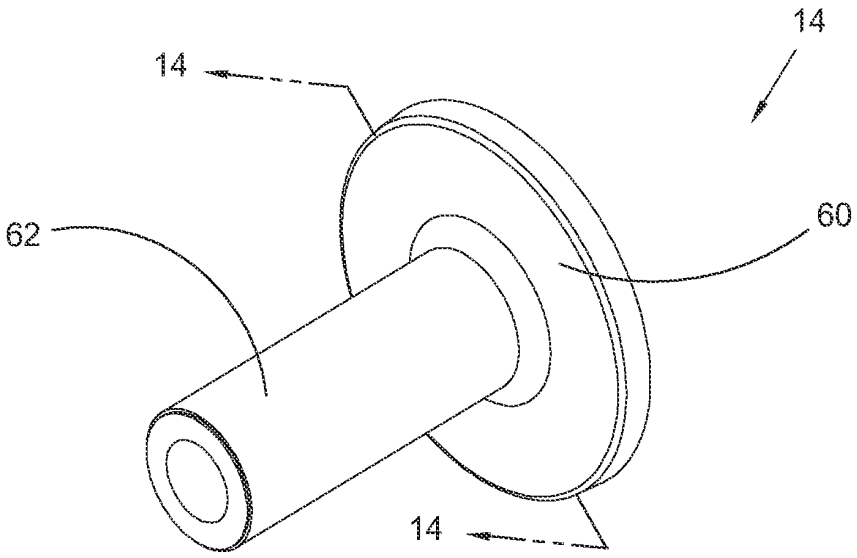

Fig. 13

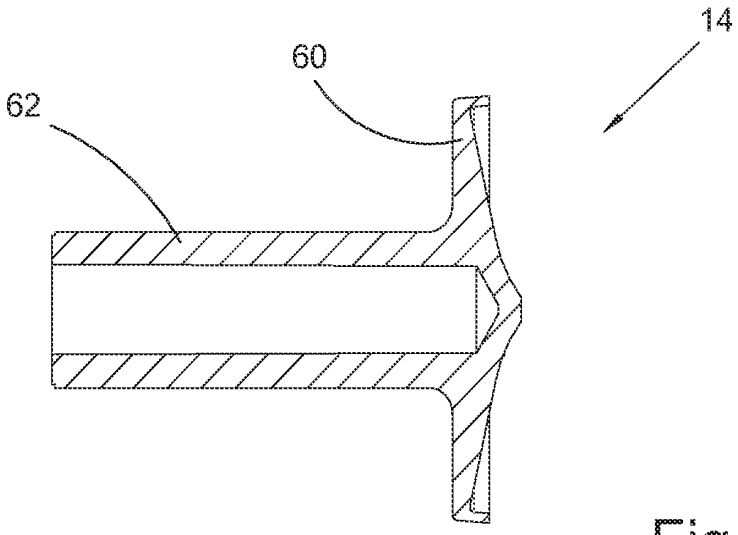

Fig. 14

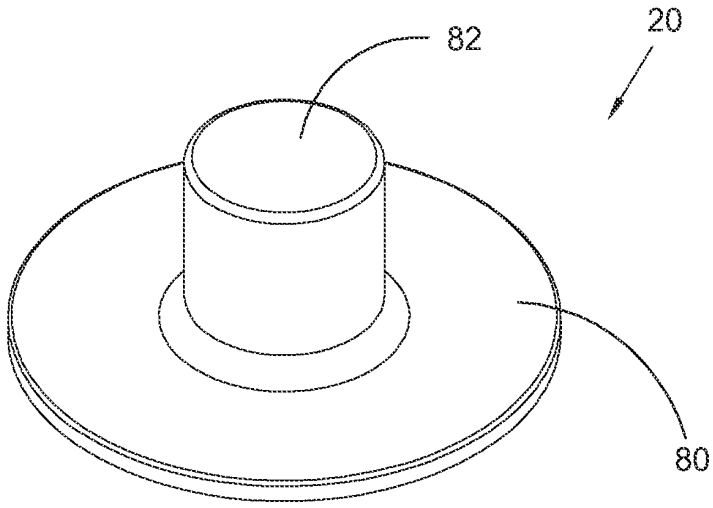

Fig. 15

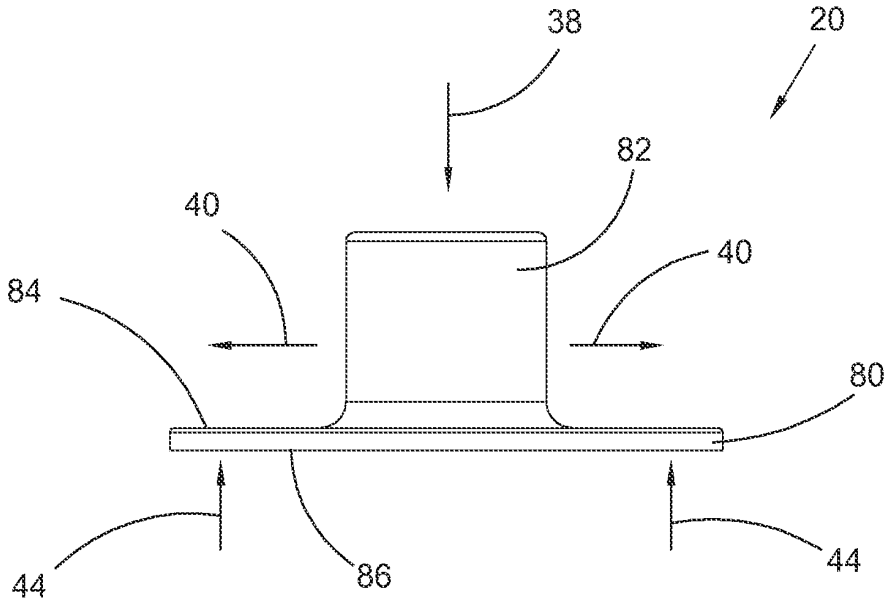

Fig. 16

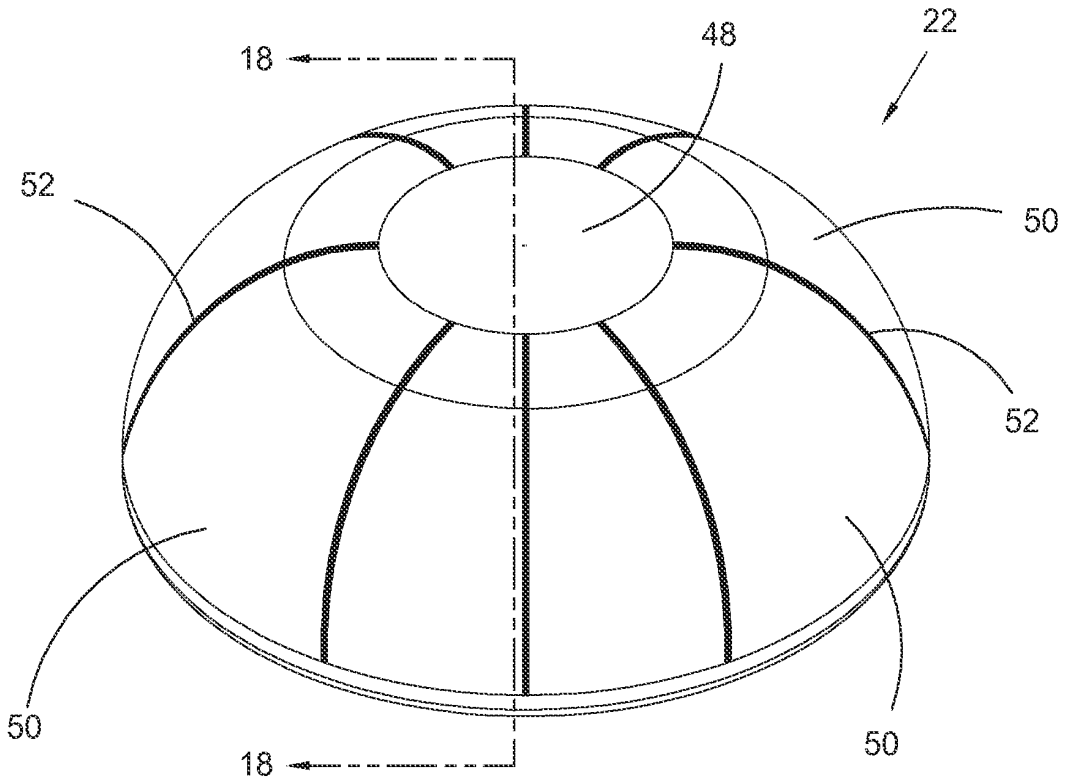

Fig. 17

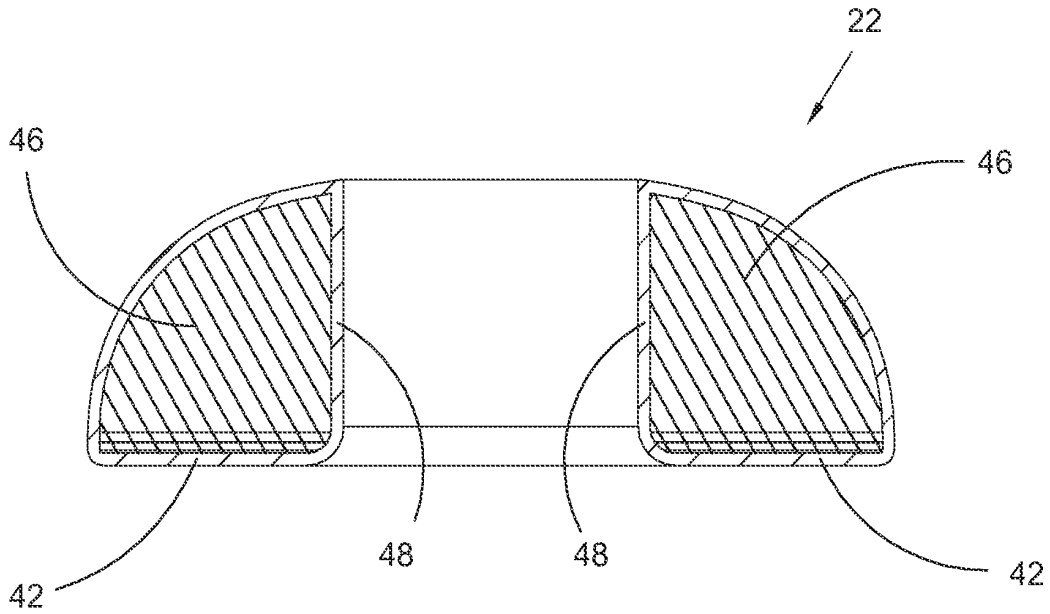

Fig. 18

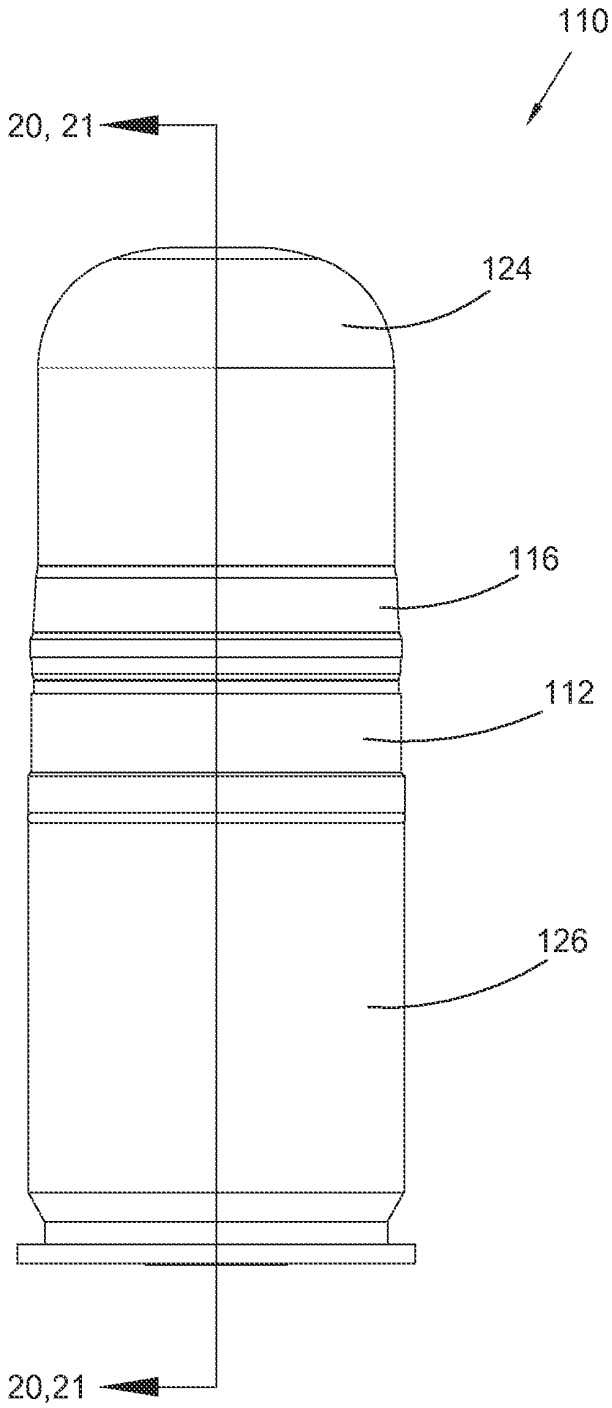

Fig. 19

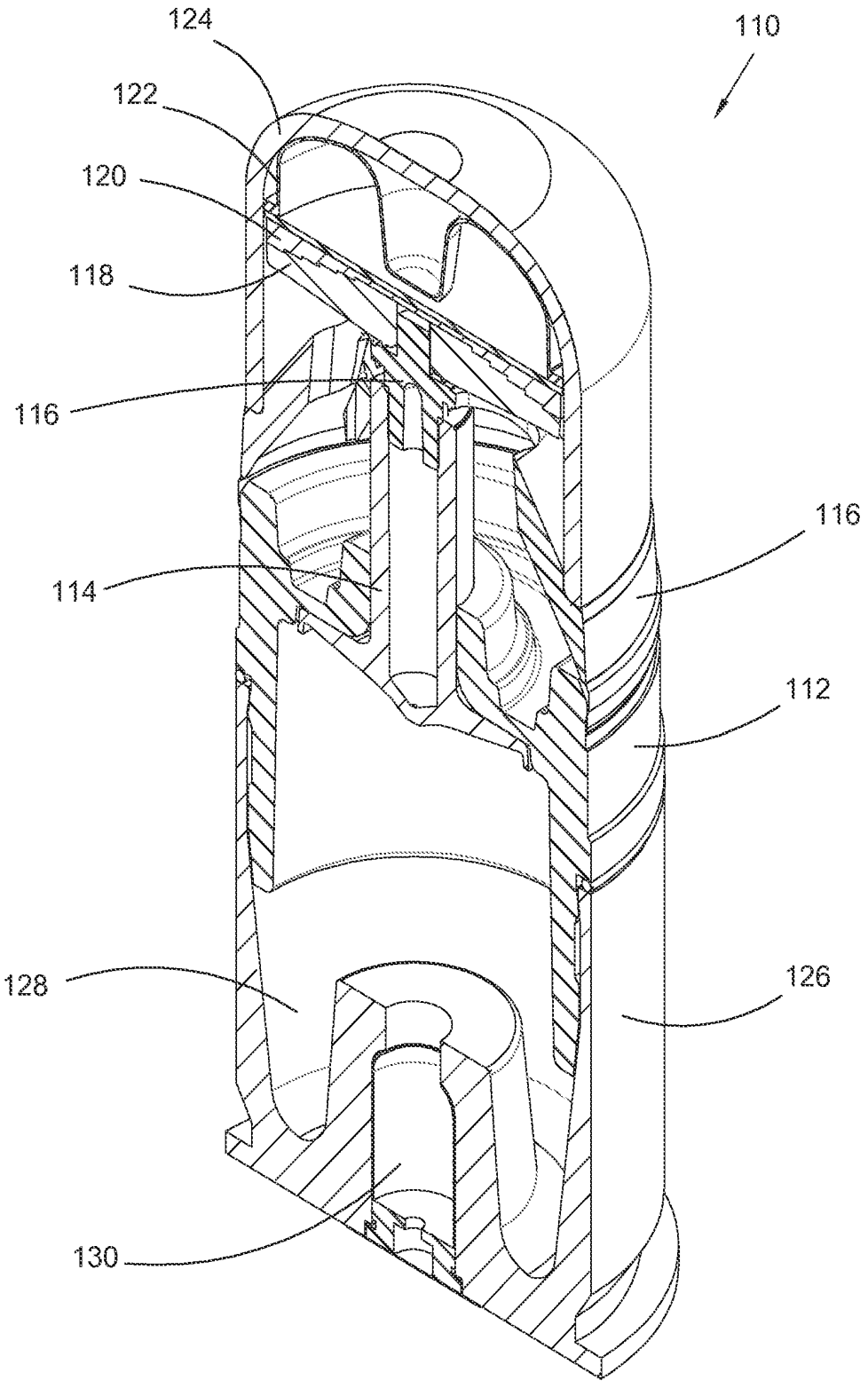

Fig. 20

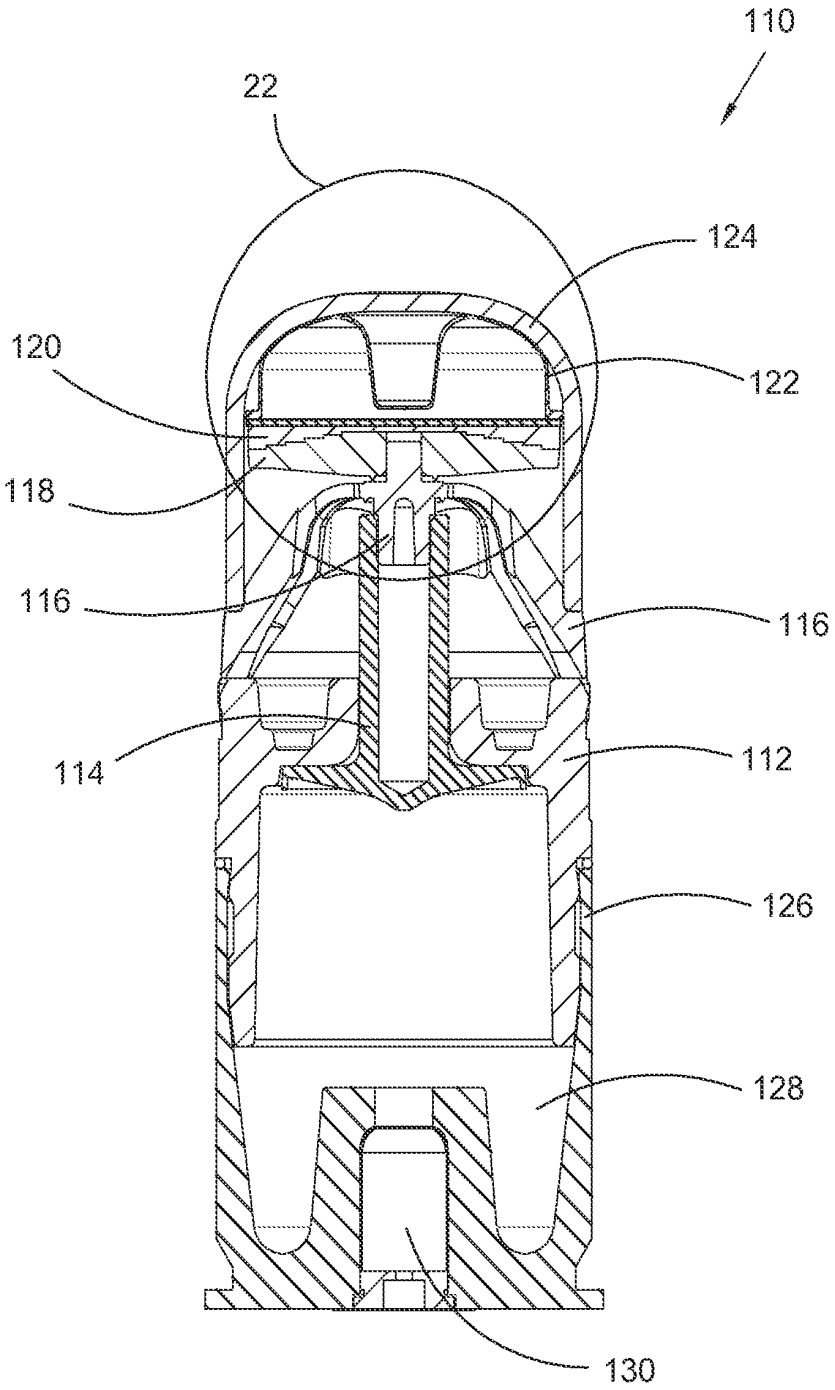

Fig. 21

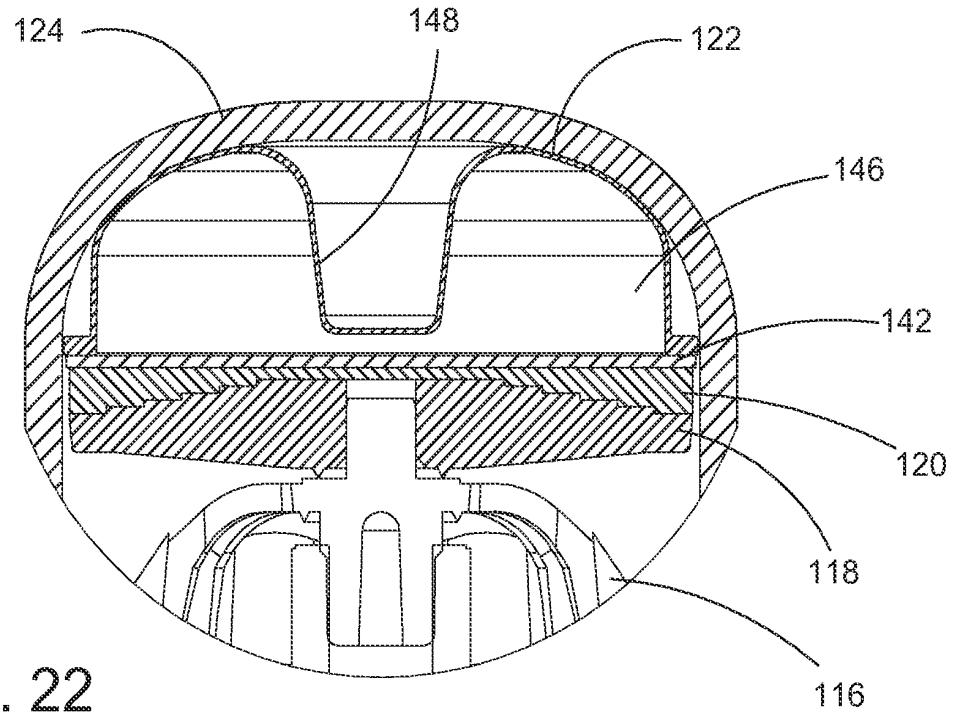

Fig. 22

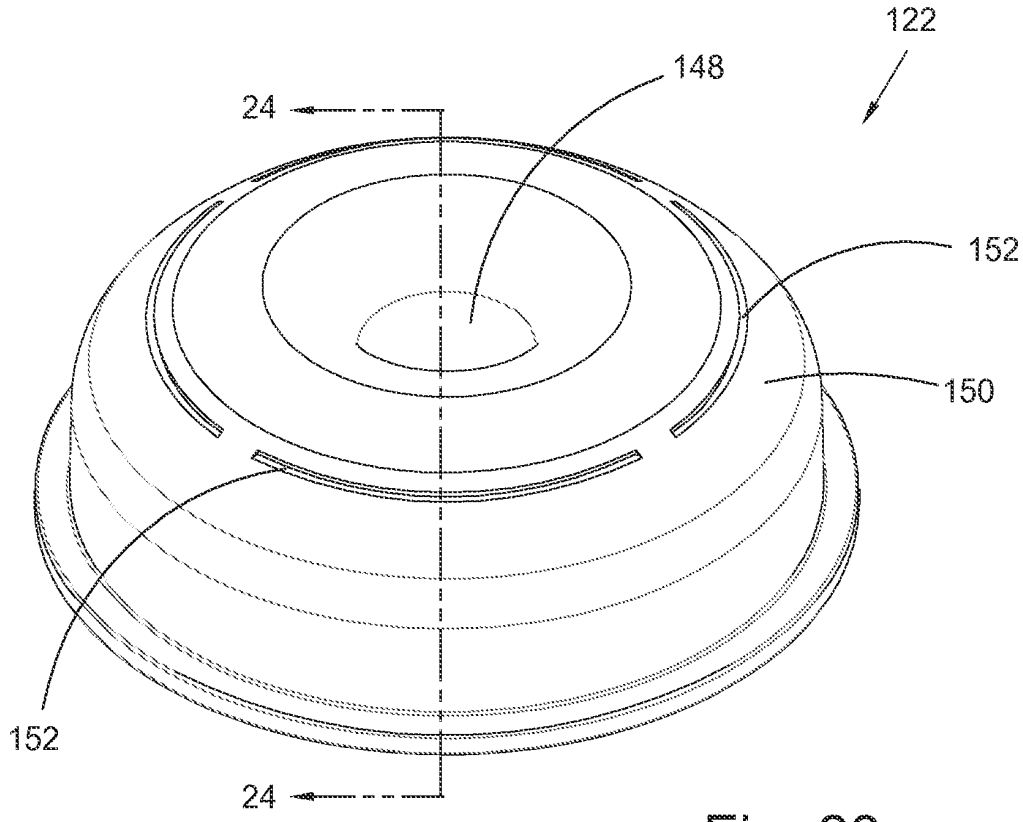

Fig. 23

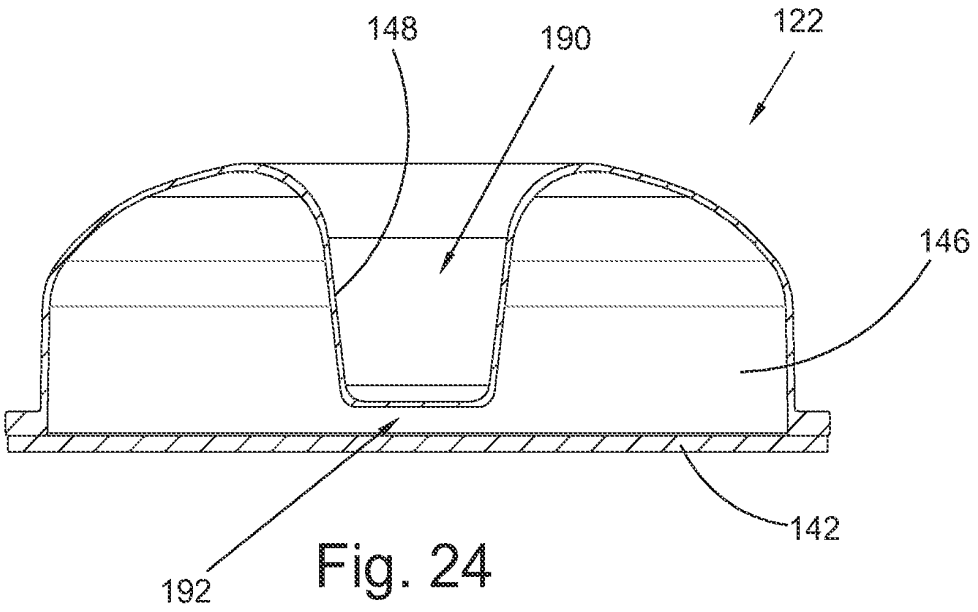

Fig. 24

REFERENCES CITED IN THE DESCRIPTION

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