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(54) **IMPROVEMENTS IN OR RELATING TO EXPLOSIVE CHARGES**

(57) An explosive charge container is provided and includes an internal partition. The container can receive explosive material on one side of the partition and can receive projectile material on the other side of the partition.

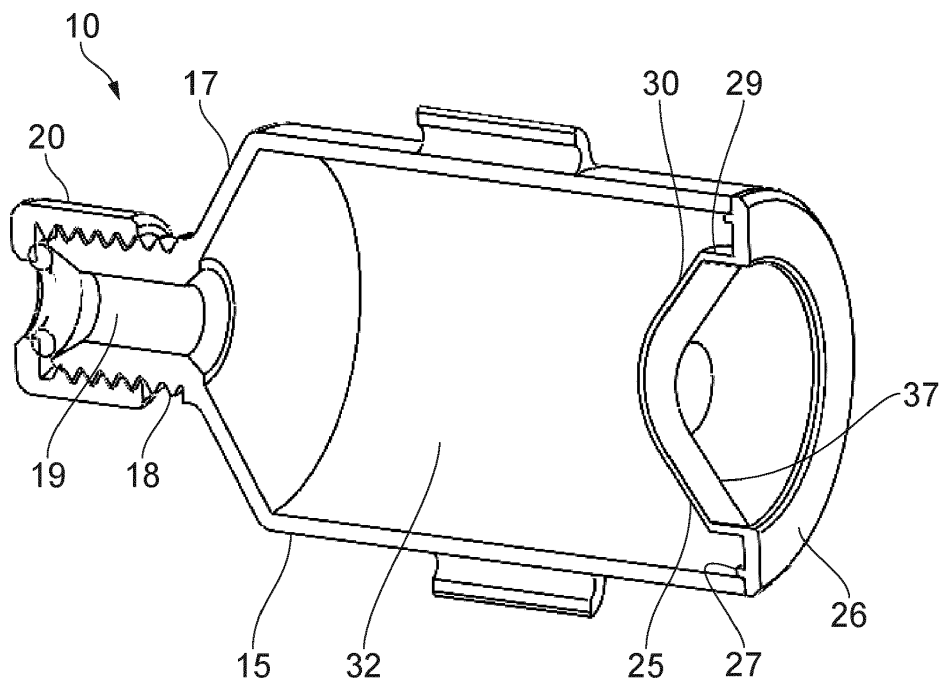


FIG. 2

Description

[0001] The present invention relates generally to an explosive charge and particularly, but not exclusively, to a shaped charge.

[0002] An aspect of the present invention provides an explosive charge container, the container includes an internal partition, the container can receive explosive material on one side of the partition and can receive projectile material on the other side of the partition.

[0003] The partition may be shaped to conform to a projectile liner receivable thereby. For example, in one embodiment a generally cone-shape partition is provided for receiving a correspondingly shaped metal liner.

[0004] The container may comprise a further partition for defining an enclosure for receiving liquid projectile material on the other side of the partition.

[0005] An end of the container may be open for receiving liquid explosive material; a liquid explosive material enclosure may thereby be defined between that open end and the partition.

[0006] The partition may be formed at or towards an end of the container.

[0007] The partition may be formed intermediate ends of the container.

[0008] The partition may be formed as a separate component that is attached or attachable to the container.

[0009] The partition may be a generally cone shape. In some embodiments a cone with a curved/domed apex may be used; other embodiments use a cone with an angular/pointed apex. A plastic cone may, for example, be used.

[0010] The partition may be formed as an integral part of the container. For example in some embodiments the partition is formed separately from but connected/attached/secured into the container so as to become integral; in other embodiments the partition is formed as part of the container (e.g. a one-piece construction).

[0011] The present invention also provides a container as described herein and fitted with a metal liner on the other side of the partition.

[0012] The container may have an initiation end, in which within the container the partition is provided by a first membrane defining a proximal enclosure for receiving liquid explosive, and in which a second membrane is provided at or towards the end of the container opposite the initiation end and spaced from the first membrane so as to define a distal enclosure for receiving liquid projectile.

[0013] The first and/or second membranes may be cones. In some embodiments the first and second membranes are cones and may, for example, have generally the same cone angles.

[0014] In some embodiments the second membrane is generally flat; for example a cone-shape first membrane in combination with a flat second membrane.

[0015] In some embodiments the first membrane fits into the container and the second membrane fits/nests

into/onto the first membrane.

[0016] The present invention also provides an explosive charge comprising a container as described herein and provided with explosive material and/or projectile material. For example a container filled with liquid explosive material and/or fitted with a metal liner and/or filled with liquid projectile material.

[0017] A further aspect of the present invention provides an explosive charge comprising a container, the container includes an internal partition, the container comprises or can receive explosive material on one side of the partition and comprises or can receive a projectile on the other side of the partition.

[0018] In aspects and embodiments of the present invention the container may have an inner partition/barrier/membrane that forms an enclosure. A projectile may be formed or provided at a front end.

[0019] The projectile could, for example, be a metal liner or a body of liquid material (such as water).

[0020] The explosive material could, for example, be a pourable explosive and/or a liquid explosive (such as nitromethane) or could be moulded/cast explosive material.

[0021] The partition may be formed at or towards an end of the container.

[0022] The partition may be formed intermediate ends of an elongate container.

[0023] The partition may be formed as a separate component that is attached or attachable to the container.

[0024] In some embodiments a projectile liner is received by the partition. The partition may have a profile that is complimentary to a liner.

[0025] One end of the container may be open for receiving liquid explosive material.

[0026] In some embodiments a liquid enclosure is defined between an open end and the partition.

[0027] In some embodiments the container can receive a detonator, for example at one end thereof.

[0028] The partition may be generally cone shaped. In some embodiments the partition could then receive a solid liner, or could be one side of a liquid enclosure for receiving liquid projectile material (such as water). A cone angle of approximately 60 degrees may, for example, be used.

[0029] The partition may be formed as an integral part of the container.

[0030] The container may be generally cylindrical (for example with a generally circular section).

[0031] The container may be generally bottle-like.

[0032] The present invention also provides an explosive charge comprising a container, the container being open at one end, the container has an internal barrier membrane to form a liquid enclosure that can be filled from the open end, and a projectile is provided in front of the membrane.

[0033] The present invention also provides an explosive shaped charge comprising a container open at one end and sealed at or towards the other end by a mem-

brane so as to define an enclosure for receiving liquid explosive, in which the membrane is shaped to conform to a projectile liner receivable by the membrane.

[0034] The present invention also provides an explosive shaped charge comprising a container open at an initiation end, within the container a first membrane is provided to define a proximal enclosure for receiving liquid explosive, a second membrane is provided at or towards the end of the container opposite the initiation end and spaced from the first membrane so as to define a distal enclosure for receiving liquid projectile.

[0035] The membranes may comprise first and second cones.

[0036] First and second membranes, where provided, may have substantially the same profile

[0037] Either or both of two cones may have a cone angle of approximately 60 degrees.

[0038] The second membrane may be generally flat.

[0039] First and second membranes may be formed as nesting components.

[0040] Charges formed in accordance with the present invention may comprise or form part of an assembly that comprises an underwater housing securable to one end of the container.

[0041] The present invention also provides an explosive shaped charge comprising a container, the container being open at one end and having a membrane so as to form a liquid enclosure that can be filled from the open end, and a projectile is provided adjacent the membrane.

[0042] The container may comprise a further compartment for receiving liquid projectile material.

[0043] The profile of the membrane may conform to the profile of a metal liner.

[0044] The present invention may also provide a charge as described herein, filled with explosive material and provided with a projectile.

[0045] The present invention may also provide a charge as described herein, filled with liquid explosive and projectile material.

[0046] A further aspect of the present invention provides an explosive shaped charge comprising a container, the container being open at one end and having a membrane so as to form a liquid enclosure that can be filled from the open end, the membrane having a shape conforming to a liner.

[0047] The membrane may be formed at or towards an end of the container opposite the open end.

[0048] The membrane may be positioned intermediate the ends of the container.

[0049] The membrane may be formed as a separate component that is attached or attachable to the container.

[0050] The membrane may be formed or received within the interior of the container.

[0051] The liner may be received by the membrane.

[0052] The liner may be positioned axially spaced from the membrane

[0053] The liquid enclosure may be formed between the liner and the membrane.

[0054] In some embodiments the open end can be closed.

[0055] The open end may receive a detonator.

[0056] The membrane may be a generally cone shape.

5 **[0057]** The membrane is formed as an integral part of the container.

[0058] The container may be generally cylindrical.

[0059] The container may be generally bottle-like.

10 **[0060]** A further aspect provides an explosive shaped charge comprising a container open at one end and sealed at or towards the other end by a membrane so as to define an enclosure for receiving liquid explosive, in which the membrane is shaped to conform to a projectile liner receivable by the membrane.

15 **[0061]** A further aspect provides an explosive shaped charge comprising a container open at an initiation end, within the container a first membrane is provided to define a proximal enclosure for receiving liquid explosive, a second membrane is provided at or towards the end of the container opposite the initiation end and spaced from the first membrane so as to define a distal enclosure for receiving liquid projectile.

[0062] The membrane may comprise first and second cones.

25 **[0063]** The first and second membranes may have substantially the same profile

[0064] The first and second membranes may nest.

[0065] Some aspects and embodiments relate to a binary explosive shaped charge.

30 **[0066]** A further aspect provides an explosive charge comprising a container, the container includes an internal partition, the container comprises or can receive explosive material on one side of the partition and comprises or can receive a projectile on the other side of the partition, in which a projectile liner is received by the partition.

35 **[0067]** A further aspect provides an explosive shaped charge comprising a container open at an initiation end, within the container a first membrane is provided to define a proximal enclosure for receiving liquid explosive, a second membrane is provided at or towards the end of the container opposite the initiation end and spaced from the first membrane so as to define a distal enclosure for receiving liquid projectile, in which the charge comprises or can receive a projectile on the other side of the second membrane.

45 **[0068]** The present invention also provides a charge as described herein, filled with liquid explosive and projectile material.

50 **[0069]** Examples of further aspects and embodiments are listed in the following numbered paragraphs.

1. An explosive charge comprising a container, the container includes an internal partition, the container comprises or can receive explosive material on one side of the partition and comprises or can receive a projectile on the other side of the partition.

2. A charge as claimed in paragraph 1, in which the

partition is formed at or towards an end of the container.

3. A charge as claimed in paragraph 1, in which the partition is formed intermediate ends of the container. 5

4. A charge as claimed in any preceding paragraph, in which the partition is formed as a separate component that is attached or attachable to the container. 10

5. A charge as claimed in any preceding paragraph, in which a projectile liner is received by the partition.

6. A charge as claimed in any preceding paragraph, in which one end of the container is open for receiving liquid explosive material. 15

7. A charge as claimed in any preceding paragraph, in which a liquid enclosure is defined between the open end and the partition. 20

8. A charge as claimed in any preceding paragraph, in which the container can receive a detonator. 25

9. A charge as claimed in any preceding paragraph, in which the partition is a generally cone shape.

10. A charge as claimed in any preceding paragraph, in which the partition is formed as an integral part of the container. 30

11. A charge as claimed in any preceding paragraph, in which the container is generally cylindrical. 35

12. A charge as claimed in any preceding paragraph, in which the container is generally bottle-like.

13. An explosive charge comprising a container, the container being open at one end, the container has an internal barrier membrane to form a liquid enclosure that can be filled from the open end, and a projectile is provided in front of the membrane. 40

14. An explosive shaped charge comprising a container open at one end and sealed at or towards the other end by a membrane so as to define an enclosure for receiving liquid explosive, in which the membrane is shaped to conform to a projectile liner receivable by the membrane. 50

15. An explosive shaped charge comprising a container open at an initiation end, within the container a first membrane is provided to define a proximal enclosure for receiving liquid explosive, a second membrane is provided at or towards the end of the container opposite the initiation end and spaced from the first membrane so as to define a distal enclosure 55

for receiving liquid projectile.

16. A charge as claimed in paragraph 15, in which the membranes comprise first and second cones.

17. A charge as claimed in paragraph 15 or paragraph 16, in which the first and second membranes have substantially the same profile

18. A charge as claimed in paragraph 16 or paragraph 17, in which either or both of the cones have a cone angle of approximately 60 degrees.

19. A charge as claimed in paragraph 18, in which the second membrane is generally flat.

20. A charge as claimed in any of paragraphs 16 to 19, in which the first and second membranes are formed as nesting components.

21. A charge as claimed in any of paragraph 16 to 20, further comprising an underwater housing securable to the second membrane end.

22. An explosive shaped charge comprising a container, the container being open at one end and having a membrane so as to form a liquid enclosure that can be filled from the open end, and a projectile is provided adjacent the membrane.

23. A charge as claimed in paragraph 22, in which the container comprises a further compartment for receiving liquid projectile material.

24. A charge as claimed in paragraph 22, in which the profile of the membrane conforms to the profile of a metal liner.

25. A charge as claimed in any preceding paragraph, filled with liquid explosive and projectile material.

26. An explosive charge comprising a container, the container includes an internal partition, the container comprises or can receive explosive material on one side of the partition and comprises or can receive a projectile on the other side of the partition, in which a projectile liner is received by the partition.

27. An explosive charge container, the container includes an internal partition, the container comprises or can receive explosive material on one side of the partition and comprises or can receive projectile material on the other side of the partition, in which a projectile liner is received by the partition.

28. An explosive shaped charge comprising a container open at an initiation end, within the container a first membrane is provided to define a proximal

enclosure for receiving liquid explosive, a second membrane is provided at or towards the end of the container opposite the initiation end and spaced from the first membrane so as to define a distal enclosure for receiving liquid projectile, in which the charge comprises or can receive a projectile on the other side of the second membrane.

29. An explosive charge container, the container includes an internal partition, the container can receive explosive material on one side of the partition and can receive projectile material on the other side of the partition.

30. A container as claimed in paragraph 29, in which the partition is shaped to conform to a projectile liner receivable thereby.

31. A charge as claimed in paragraph 29, in which the container comprises a further partition for defining an enclosure for receiving liquid projectile material on the other side of the partition.

32. A charge as claimed in any preceding paragraph, in which an end of the container is open for receiving liquid explosive material and in which a liquid explosive material enclosure is defined between that open end and the partition.

33. A charge as claimed in any preceding paragraph, in which the partition is formed at or towards an end of the container.

34. A charge as claimed in any of paragraphs 29 to 33, in which the partition is formed intermediate ends of the container.

35. A charge as claimed in any preceding paragraph, in which the partition is formed as a separate component that is attached or attachable to the container.

36. A charge as claimed in any preceding paragraph, in which the partition is a generally cone shape.

37. A charge as claimed in any preceding claim, in which the partition is formed as an integral part of the container.

38. A container as claimed in paragraph 29 and fitted with a metal liner on the other side of the partition.

39. A container as claimed in paragraph 29, in which the container has an initiation end, in which within the container the partition is provided by a first membrane defining a proximal enclosure for receiving liquid explosive, and in which a second membrane is provided at or towards the end of the container opposite the initiation end and spaced from the first

membrane so as to define a distal enclosure for receiving pourable/liquid projectile material.

40. A container as claimed in paragraph 39, in which the first and/or second membrane is a cone.

41. A container as claimed in paragraph 39 or paragraph 40, in which the second membrane is generally flat.

42. A container as claimed in any of paragraphs 39 to 41, in which the first membrane fits into the container and in which the second membrane nests into the first membrane.

43. An explosive charge comprising a container as claimed in any preceding paragraph and provided with explosive material and/or projectile material.

[0070] Different aspects and embodiments of the invention may be used separately or together.

[0071] Further particular and preferred aspects of the present invention are set out in the accompanying independent and dependent claims. Features of the dependent claims may be combined with the features of the independent claims as appropriate, and in combination other than those explicitly set out in the claims. Each aspect can be carried out independently of the other aspects or in combination with one or more of the other aspects.

[0072] The present invention will now be more particularly described, by way of example, with reference to the accompanying drawings.

[0073] The example embodiments are described in sufficient detail to enable those of ordinary skill in the art to embody and implement the systems and processes herein described. It is important to understand that embodiments can be provided in many alternative forms and should not be construed as limited to the examples set forth herein.

[0074] Accordingly, while embodiments can be modified in various ways and take on various alternative forms, specific embodiments thereof are shown in the drawings and described in detail below as examples. There is no intent to limit to the particular forms disclosed. On the contrary, all modifications, equivalents, and alternatives falling within the scope of the appended claims should be included. Elements of the example embodiments are consistently denoted by the same reference numerals throughout the drawings and detailed description where appropriate.

[0075] Unless otherwise defined, all terms (including technical and scientific terms) used herein are to be interpreted as is customary in the art. It will be further understood that terms in common usage should also be interpreted as is customary in the relevant art and not in an idealised or overly formal sense unless expressly so defined herein.

[0076] In the following description, all orientational terms, such as upper, lower, radially and axially, are used in relation to the drawings and should not be interpreted as limiting on the invention.

[0077] Referring first to Figures 1 to 3 there is shown a charge generally indicated 10.

[0078] The charge 10 comprises a generally cylindrical bottle-like container 15. The container includes a generally cylindrical body 16. At one end of the body an inclined wall 17 extends radially inwards. At the centre of the wall 17 a neck 18 is provided and has a central passage 19. In this embodiment a separate screw threaded collar 20 is provided for receiving a detonator and can be screwed onto the neck 18.

[0079] The other end of the body 16 is closed by a partition/barrier/barrier membrane 25. The membrane 25 has an annular flange 26 that fits onto the open end of the body. A short annular skirt 27 depends from the flange. The skirt 27 is positioned to fit into the interior of the body.

[0080] At the centre of the flange 26 a longitudinal annular leg 29 extends and is closed by a concave plate 30 (so the plate 30 is "inside" the body).

[0081] The interior of the body provides an enclosure 32 for receiving liquid explosive, such as nitromethane.

[0082] A projectile in the form of a metal cone 37 (such as magnesium, aluminium or copper) is provided. The shape/profile of the cone 37 is complimentary with the shape of the plate/leg. The charge diameter is greater than the projectile diameter.

[0083] In some ways, therefore, this could be thought of as a bottle with the correct front/bottom profile to receive a liner.

[0084] The container could be formed from a plastics material.

[0085] The cone could be formed as a thin plastic membrane.

[0086] A further example of a charge of the type described in relation to Figures 1 to 3 is shown in Figures 4 to 6.

[0087] The charge 10 is shown assembled in Figure 6. The body 116 can be filled with liquid explosive and the collar 120 is screwed onto the body 116. A detonator 140 is fitted into the collar and a projectile 137 is fitted into the membrane 125.

[0088] In use, activation of the detonator 140 causes detonation of the liquid explosive material, which in turn causes projection of the projectile 137.

[0089] Figures 7 to 9 show a charge 210 formed according to a further embodiment.

[0090] In a similar way to the charge 10 and 110, the charge 210 has a cylindrical container 215 with a screw threaded neck 218 at one end of its body 216. The other end of the body 216 is closed by a double cone arrangement. First and second cone members 250, 255 are placed, axially spaced from each other, into the interior of the body.

[0091] In this embodiment the cone members 250, 255

are provided in a nested format, with the second cone member nested inside the first cone member (with the cone apices being axially mutually spaced from each other). A liquid explosive material compartment 232 is formed between the first cone member and the neck. A liquid projectile material compartment 233 is formed between the two cones members.

[0092] In some embodiments either/both of the cone members are welded/adhered or otherwise permanently fixed into the body.

[0093] The container could be formed from a plastics material.

[0094] The cones could be formed as thin plastic membranes.

[0095] A further example of a charge 210 of the type described in relation to Figures 7 to 9 is shown in Figures 10 and 11.

[0096] Figure 10 shows the body with the collar screwed on. In Figure 11 the cone member has been inserted.

[0097] The body can be filled, for example, with liquid explosive and water. A detonator can be fitted into the collar.

[0098] In use, activation of the detonator causes detonation of the liquid explosive material, which in turn causes the water to be projected. The liquid explosive may be binary e.g. a sensitizer could be added first and then liquid explosive material.

[0099] The first cone (defining the explosive material compartment/chamber) could be formed as part of the container, or could be provided separately and pre-fitted or fitted at the time of use. The second cone could be fitted/secured after filling with projectile material.

[0100] Figures 12 and 13 show the charge 210 forming part of an underwater-compatible variation. An underwater housing 260 is provided and fits over/onto the end of the assembled charge.

[0101] Figures 14 and 15 show a charge 310 formed according to a further embodiment. The charge 310 is similar to the charge 210, having a liquid explosive material compartment 332 and a liquid projectile material compartment 333.

[0102] In this embodiment a front membrane 355 has a generally flat profile and an inner cone 350 is provided with a (approximately) 60 degree angle.

[0103] The figures show different variants formed in accordance with the present invention. The interlayer/liner/membrane between the explosive and the projectile, whether that be a liquid projectile (e.g. water) or a metal (e.g. magnesium) liner.

[0104] Some embodiments therefore allow the production of charges that do not have the projectile in and/or don't have explosive material in; they can be added at an appropriate time. Transport/storage of an empty or partially empty (and not fully enabled) charge container is therefore much safer.

[0105] In some embodiment any sort of projectile could be used/fitted, for example a composite or single material

projectile.

[0106] Although illustrative embodiments of the invention have been disclosed in detail herein, with reference to the accompanying drawings, it is understood that the invention is not limited to the precise embodiments shown and that various changes and modifications can be effected therein by one skilled in the art without departing from the scope of the invention as defined by the appended claims and their equivalents.

Claims

1. An explosive charge container, the container includes an internal partition, the container comprises or can receive explosive material on one side of the partition and comprises or can receive projectile material on the other side of the partition. 5
2. A container as claimed in claim 1, in which the partition is shaped to conform to a projectile liner receivable thereby. 10
3. A container as claimed in claim 1, in which the container comprises a further partition for defining an enclosure for receiving liquid projectile material on the other side of the partition. 25
4. A container as claimed in any preceding claim, in which an end of the container is open for receiving liquid explosive material and in which a liquid explosive material enclosure is defined between that open end and the partition. 30
5. A container as claimed in any preceding, in which the partition is formed at or towards an end of the container. 35
6. A container as claimed in any of claims 1 to 4, in which the partition is formed intermediate ends of the container. 40
7. A container as claimed in any preceding claim, in which the partition is formed as a separate component that is attached or attachable to the container. 45
8. A container as claimed in any preceding claim, in which the partition is a generally cone shape.
9. A container as claimed in any preceding claim, in which the partition is formed as an integral part of the container. 50
10. A container as claimed in claim 1 and fitted with a metal liner on the other side of the partition. 55
11. A container as claimed in claim 1, in which the container has an initiation end, in which within the con-

tainer the partition is provided by a first membrane defining a proximal enclosure for receiving liquid explosive, and in which a second membrane is provided at or towards the end of the container opposite the initiation end and spaced from the first membrane so as to define a distal enclosure for receiving liquid projectile.

12. A charge as claimed in claim 11, in which the first and/or second membrane is a cone.
13. A charge as claimed in claim 11 or claim 12, in which the second membrane is generally flat.
14. A container as claimed in any of claims 11 to 13, in which the first membrane fits into the container and in which the second membrane nests into the first membrane.
15. An explosive charge comprising a container as claimed in any preceding claim and provided with explosive material and/or projectile material.

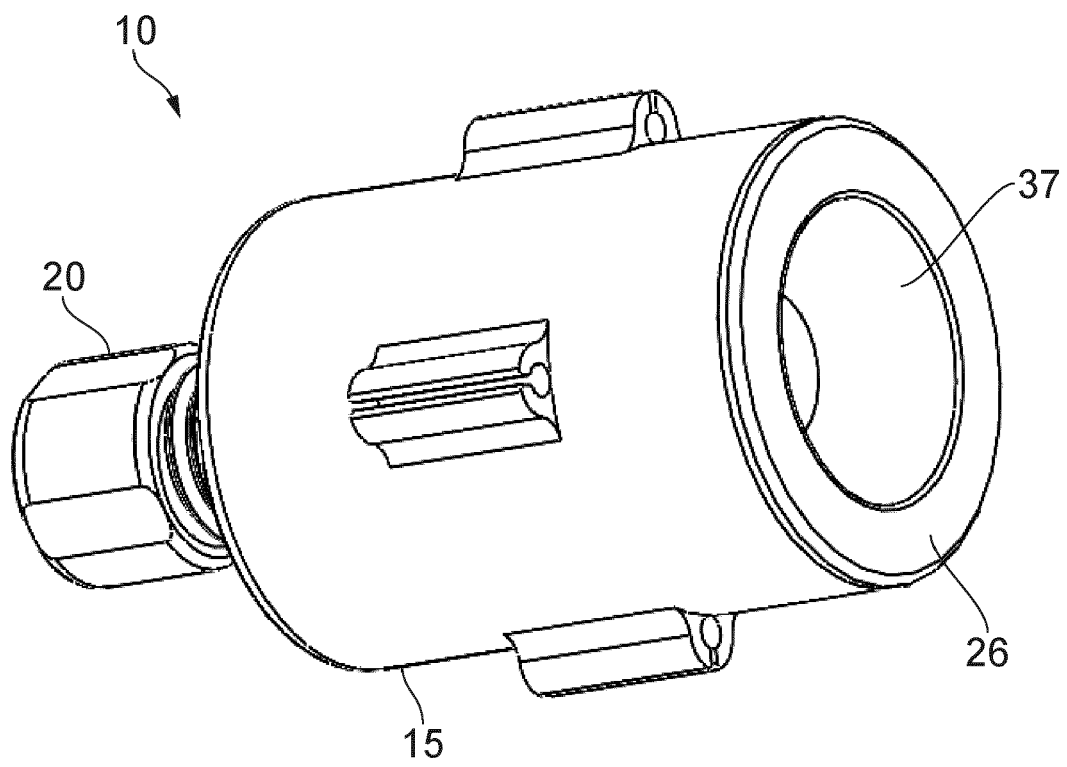


FIG. 1

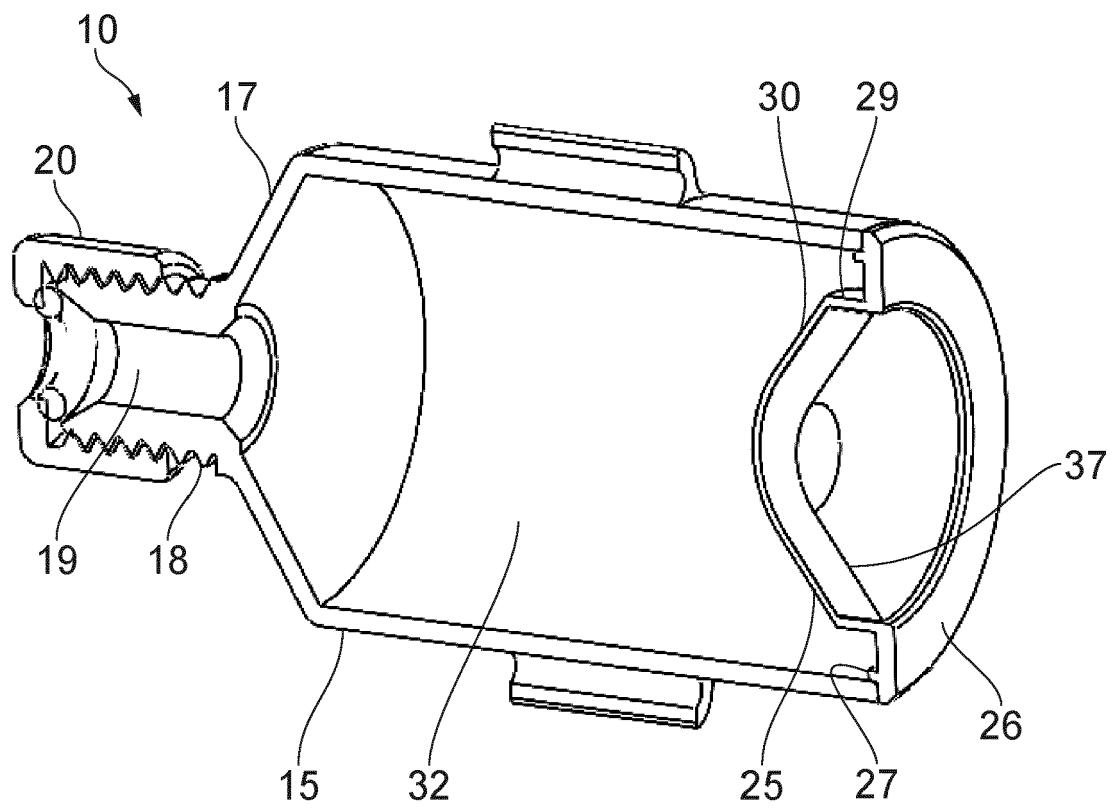


FIG. 2

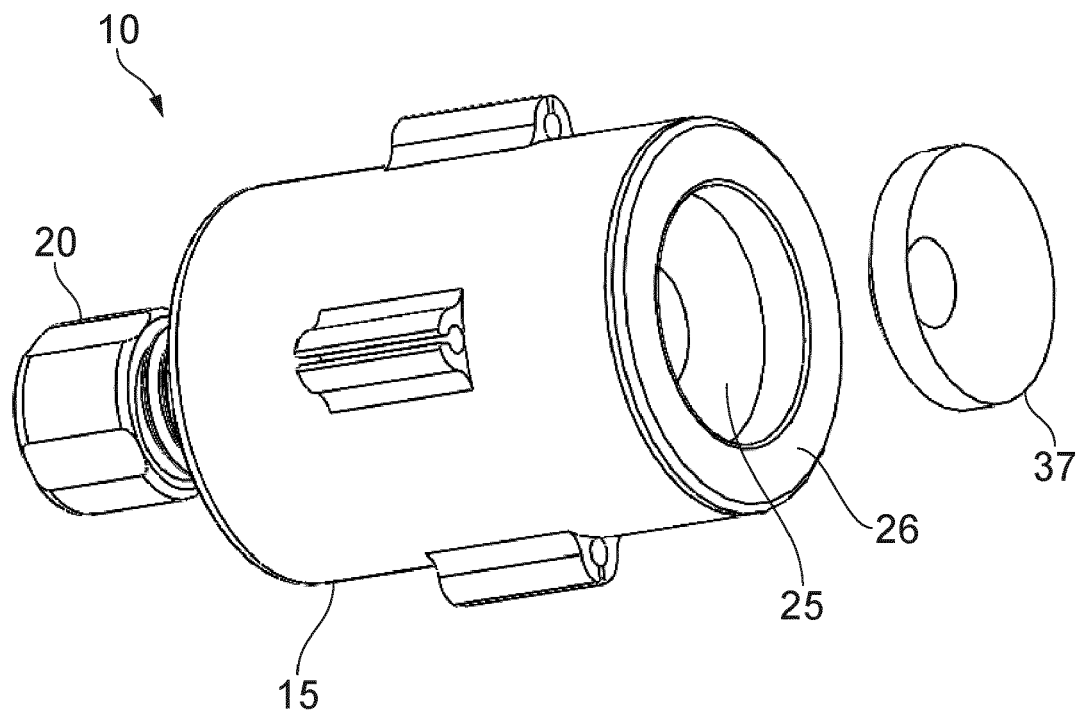


FIG. 3

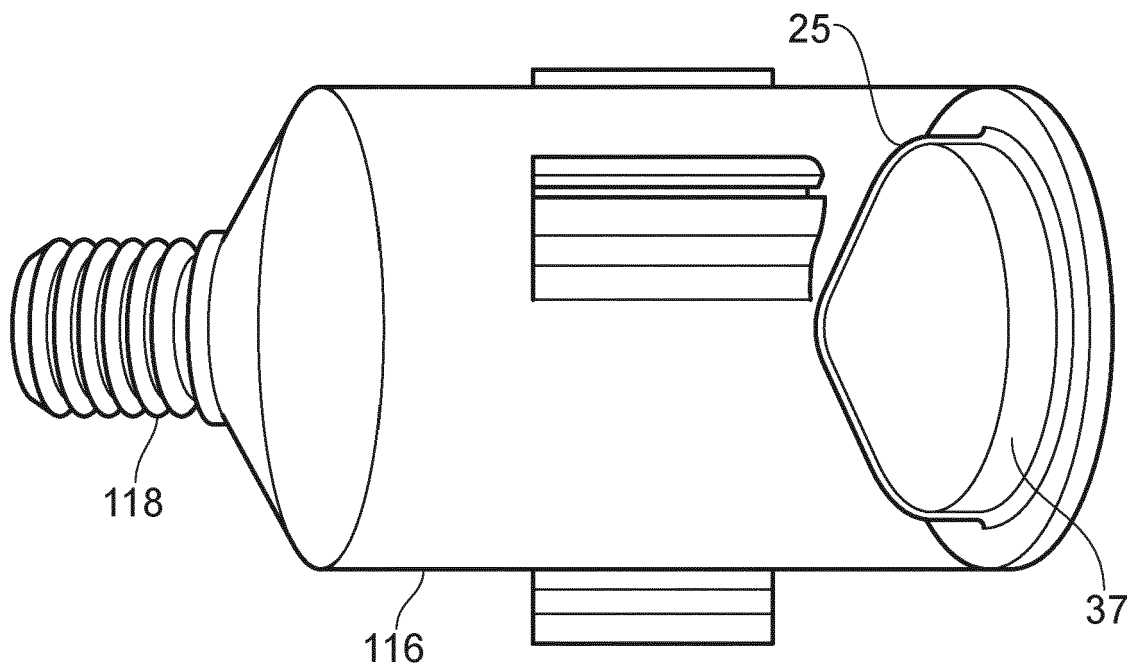


FIG. 4

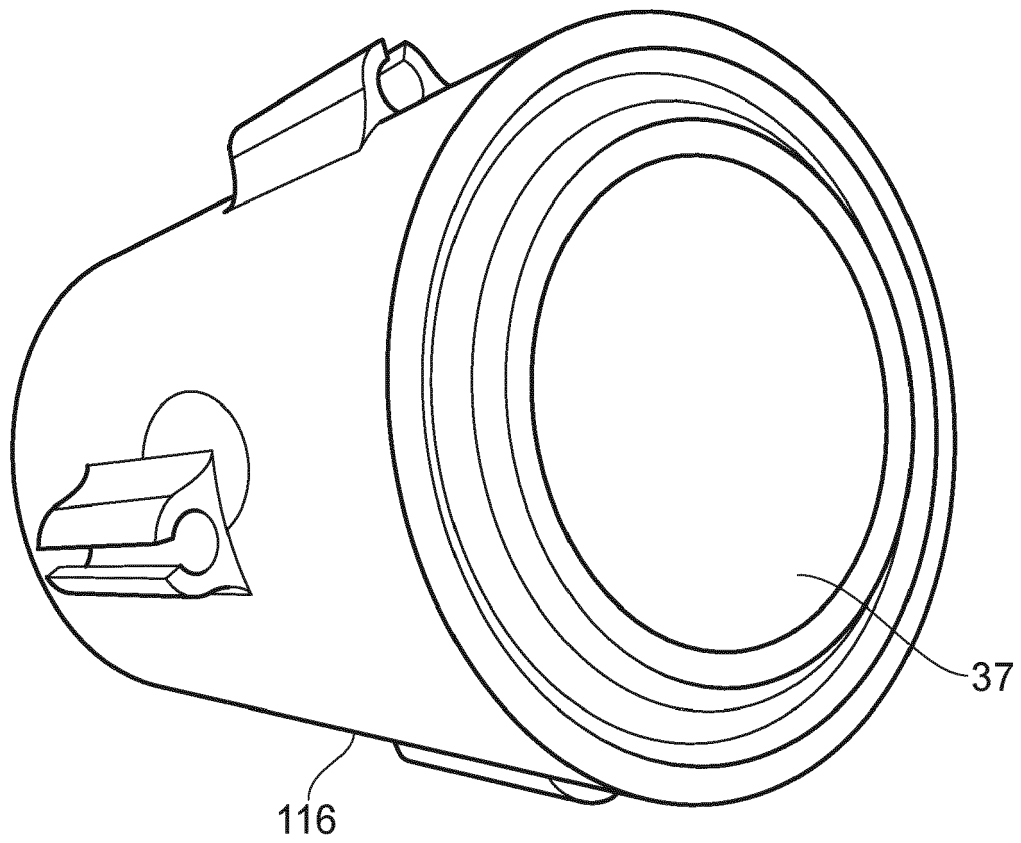


FIG. 5

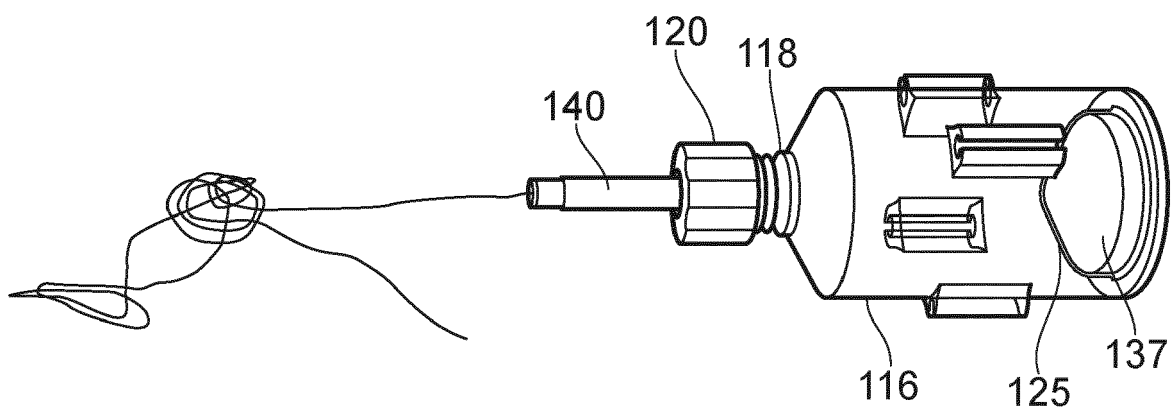


FIG. 6

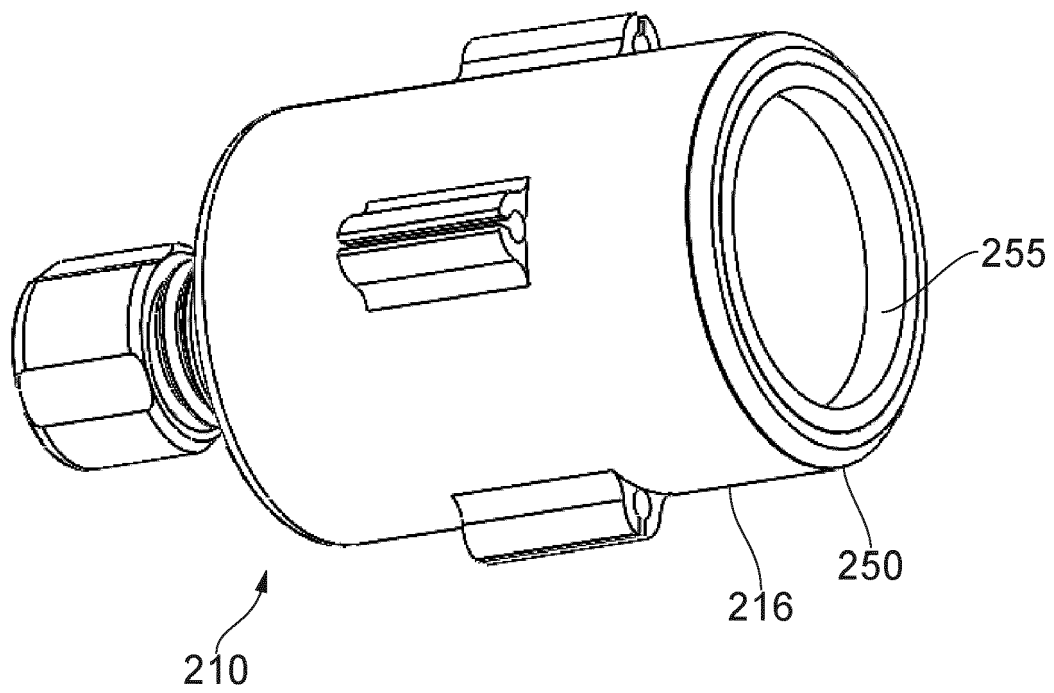


FIG. 7

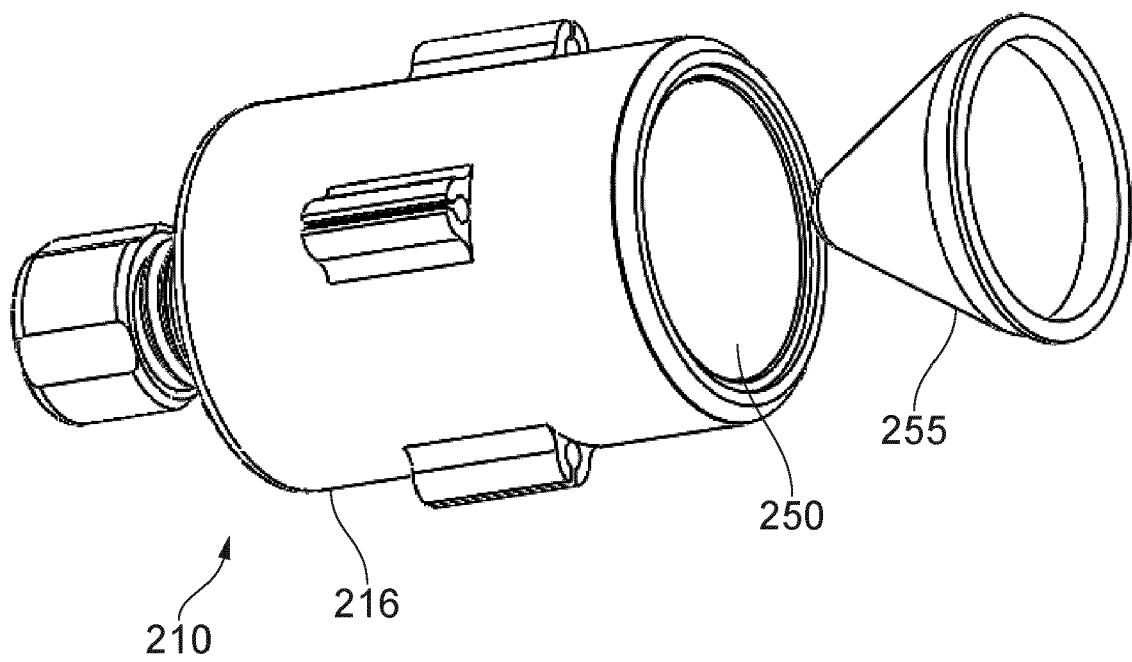


FIG. 8

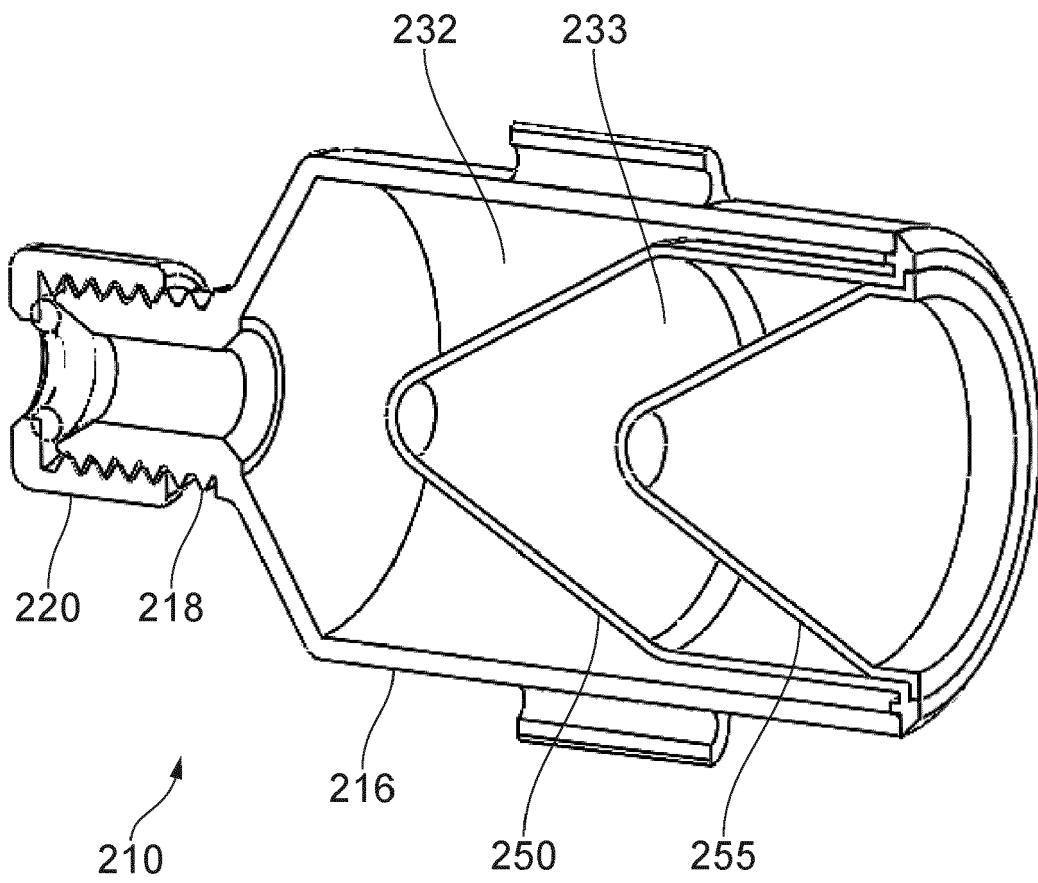


FIG. 9

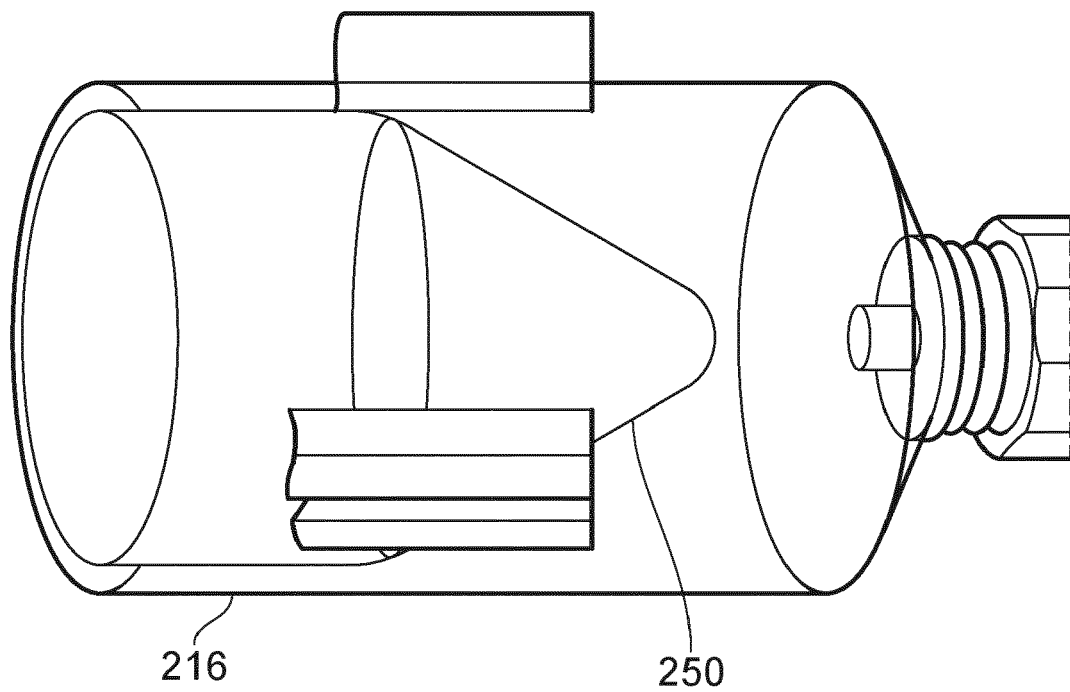


FIG. 10

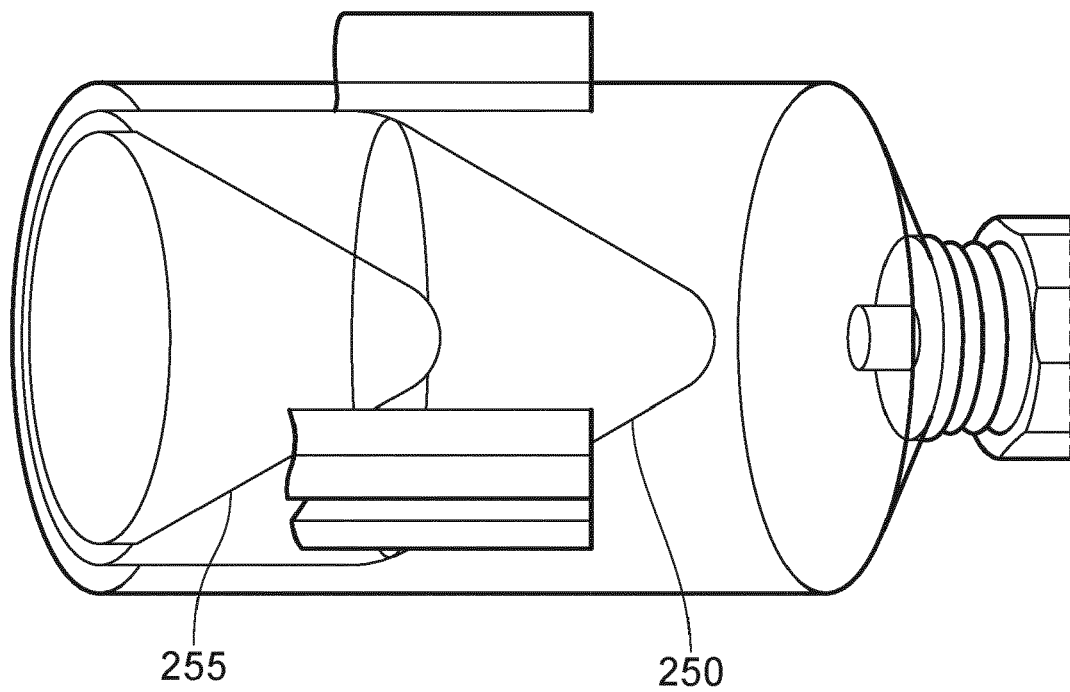


FIG. 11

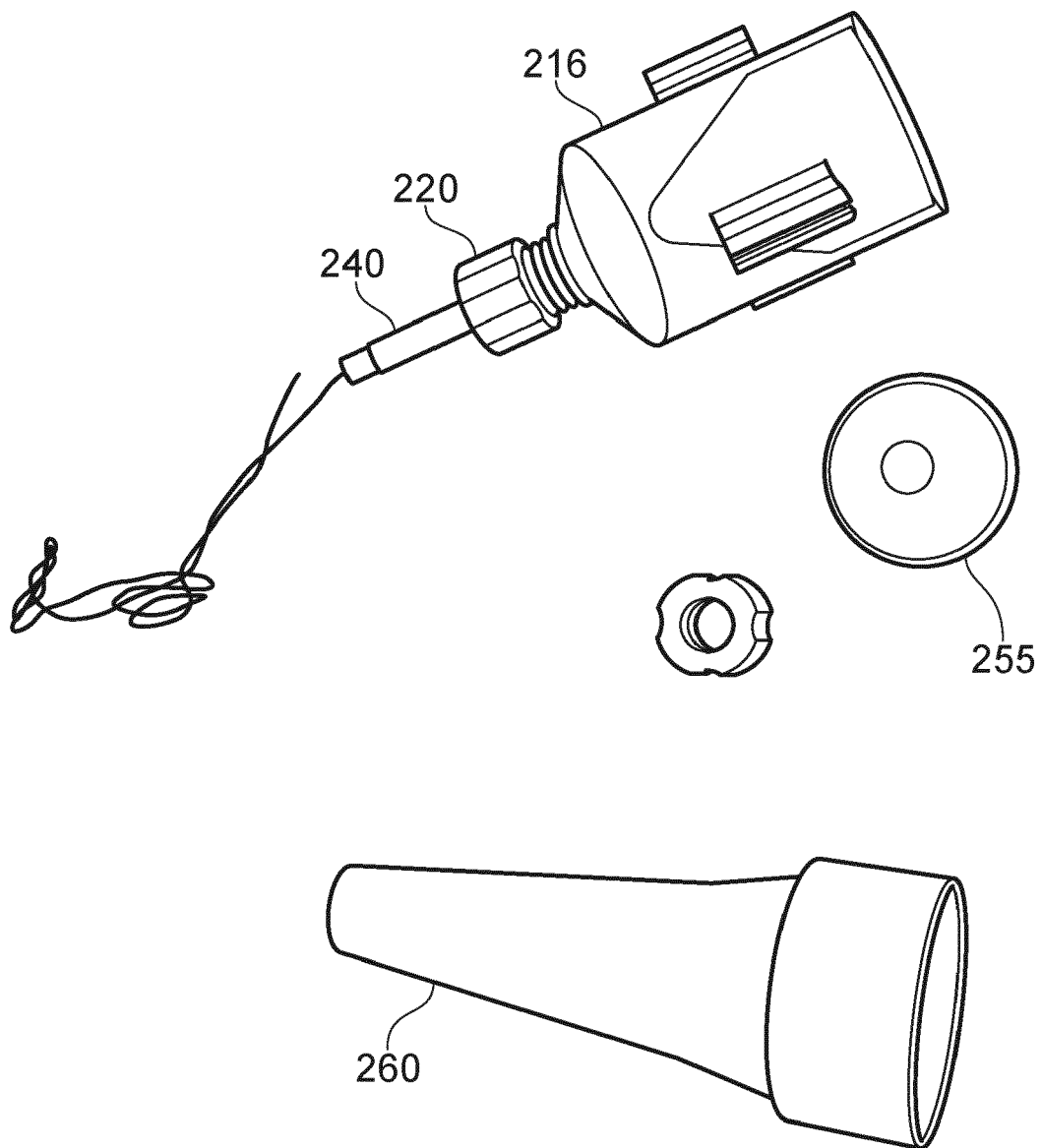


FIG. 12

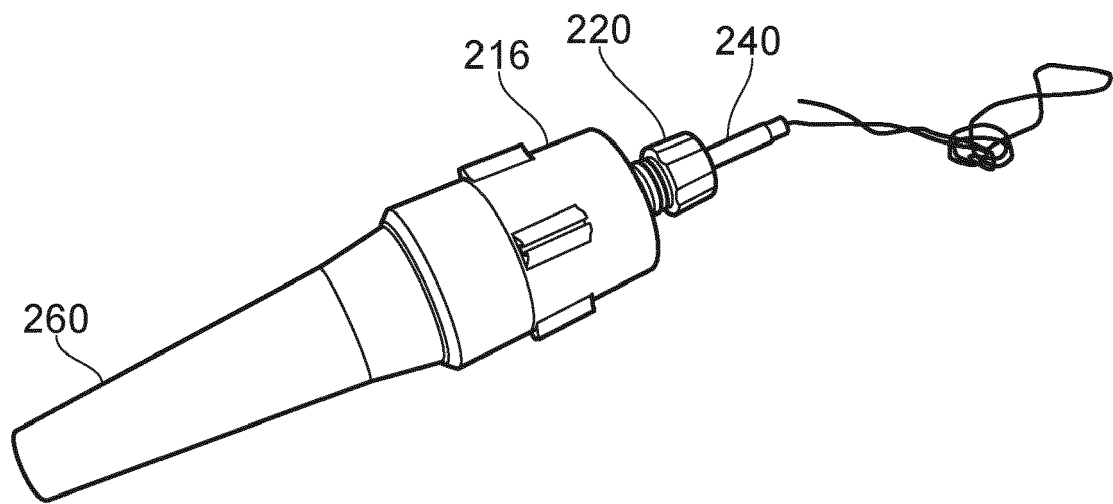


FIG. 13

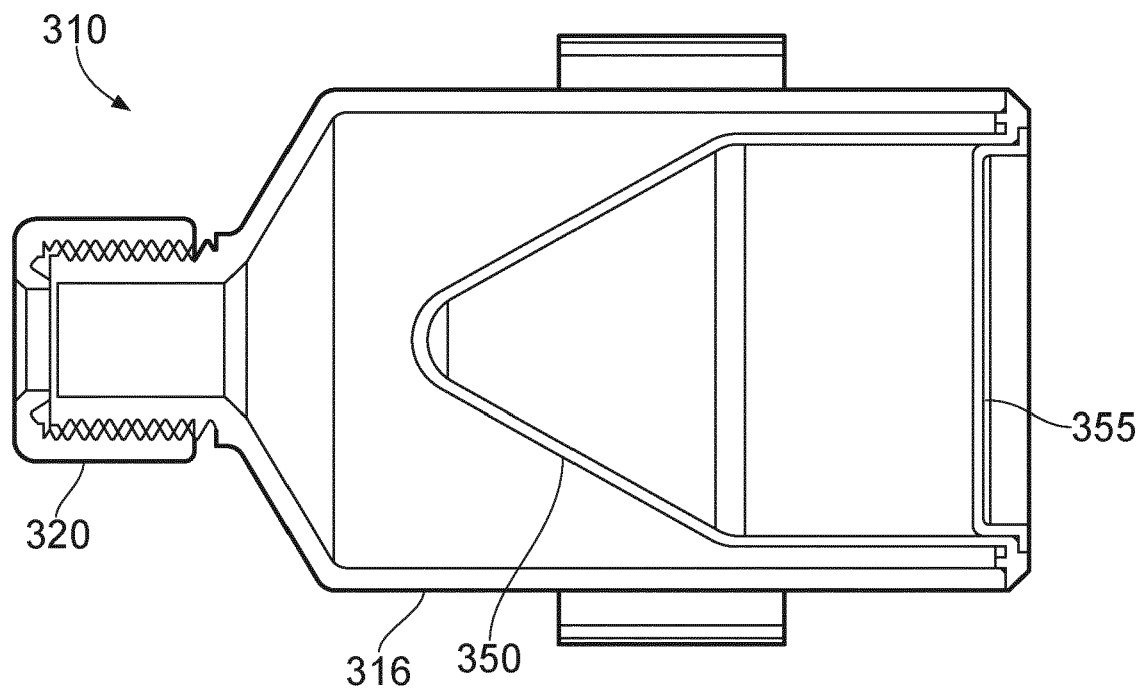


FIG. 14

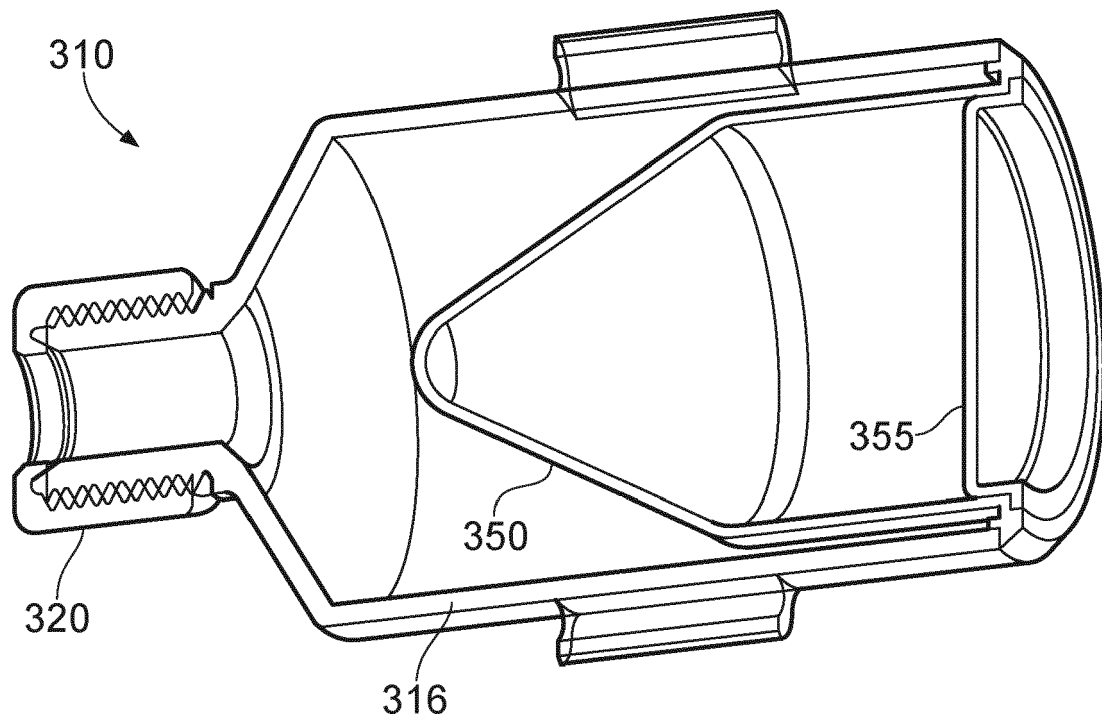


FIG. 15



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 16 8891

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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