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(54) NOZZLES, HEADS AND AEROSOL DISPERSERS

(57) The present disclosure relates to aerosol dispensers, heads for aerosol dispensers and nozzles for heads for aerosol dispensers. A nozzle (1) for spraying a fluid of an aerosol container (41) is provided. The nozzle (1) comprises a proximal region (25) configured to receive a fluid transportation tube (30) configured to provide fluid communication to the aerosol container (41). The nozzle (1) further comprises a distal region (26) comprising an output through hole (16), the output through hole (16) having a diameter of, or less than, 0.15 mm, and having a length between 2 and 6 mm.

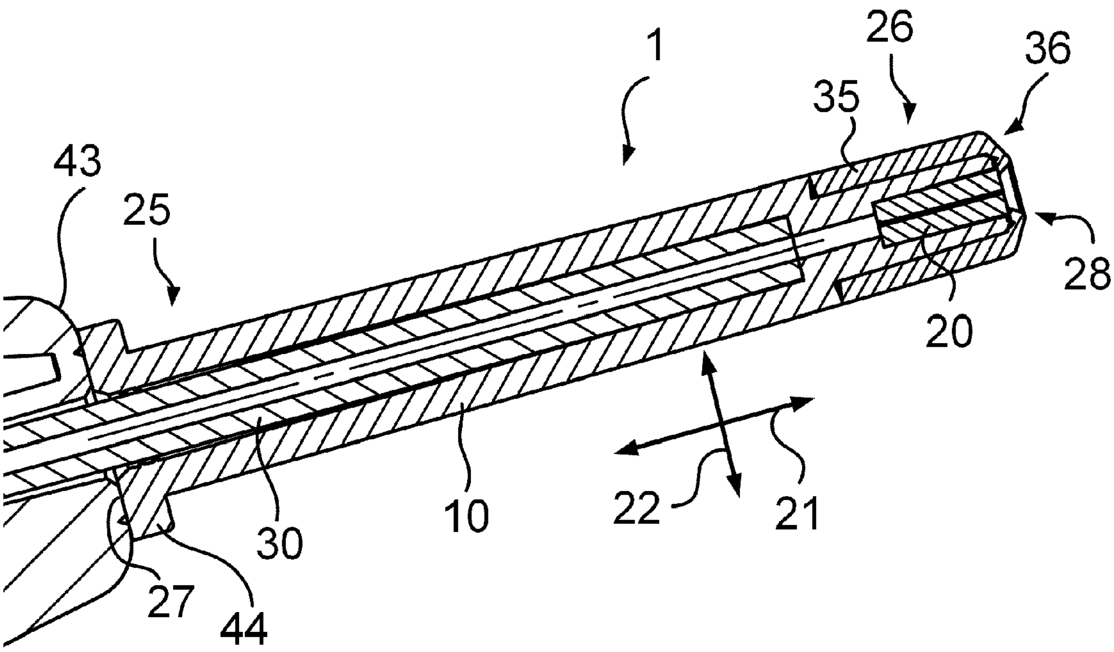

Fig. 1A

Description

FIELD

[0001] The present disclosure relates to aerosol dispensers, in particular to heads for aerosol dispensers and nozzles for heads for aerosol dispensers. More in particular, the present disclosure relates to aerosol dispensers, heads and nozzles for use in cryotherapy.

BACKGROUND

[0002] Post-infection topical treatments are usually used to treat skin warts occurring on the sole or toes of the foot and/or other varieties of warts or other skin diseases. From these topical treatments cryotherapy is well-known.

[0003] Cryotherapy is usually used in the medical field for the removal of skin lesions from the body of mammals, including the human body. Cryotherapy refers to treatments in which surface skin lesions are frozen. However, cryotherapy may sting and may be painful, both when being performed and for a variable period afterwards. On some occasions, the extreme cold can freeze blood vessels supplying blood to abnormal cells.

[0004] Some known cryotherapy techniques combine the effectiveness of traditional cryotherapy with a modern aerosol technique. This involves rather simple and user-friendly treatment devices. In these techniques, the coolant solution is usually stored in a pressurized container and, upon demand (i.e. upon activation by a user), an amount of coolant solution is dispensed from the container.

[0005] One known aerosol container comprises norflurane. Norflurane is also known as HFC-134A, and has a chemical structure known as 1,1,1,2-tetrafluoroethane. Under pressure, 1,1,1,2-tetrafluoroethane is compressed into a liquid, which upon vaporization absorbs a significant amount of thermal energy. As a result, it will greatly lower the temperature of any object that it contacts as it evaporates, i.e. in this case the skin lesions or warts.

[0006] Aerosol heads and aerosol dispensers suitable for cryotherapy are described in WO 2018115447 A1. The aerosol dispensers described in this prior document represent a significant improvement in terms of precision of spray and user-friendliness. More precise spray beams may help to treat a skin lesion while reducing damage to healthy skin surrounding the skin lesion and reducing unnecessary spillage.

[0007] The present disclosure aims at providing further improvements over the prior art.

SUMMARY

[0008] In an aspect of the present disclosure, a nozzle for spraying a fluid of an aerosol container is provided. The nozzle comprises a proximal region configured to receive a fluid transportation tube which is configured to provide fluid communication with the aerosol container. The nozzle further comprises a distal region comprising an output through hole. The output through hole has a diameter of, or less than, 0.15 mm. The output through hole has a length between 2 and 6 mm.

[0009] According to this aspect, a nozzle has an output through hole through which a fluid of an aerosol container received from a tube connected to the aerosol container can be ejected. The output through hole has specific dimensions which allow to emit a particularly narrow beam. Narrow may herein be understood particularly as maintaining relatively small cross-sectional dimensions of the spray over an increased spray length, i.e. the spray is not only narrow when exiting the nozzle but maintains the narrow spray over an increased spraying path.

[0010] Spraying precision can therefore be increased even when a relatively inexperienced user or medical professional is applying the spray. If for example a fluid is sprayed for treating a skin lesion with cryotherapy, the risk of damaging healthy skin tissue surrounding the skin lesion may be reduced. Also, waste or unnecessary use of active ingredients may be reduced. At the same time, the dimensions were selected to maintain a suitable pressure drop and manufacturability.

[0011] The output through hole may in some examples have a diameter between 0.05 and 0.15 mm, in particular between 0.08 and 0.12 mm. Such diameters may allow for increased precision when spraying while being relatively easy to provide.

[0012] Also, the specific dimensions chosen have been found to be more patient-friendly in terms of the noise produced while spraying. Specifically for young patients, e.g. children, the noise that is produced while spraying can be uncomfortable. The dimensions of the output through hole reduce the noise.

[0013] In some examples, the nozzle may comprise a nozzle output tube, the nozzle output tube including the output through hole and the nozzle output tube being inserted in the distal region. In some of these examples, the nozzle output tube may comprise, or may be made of, polyetheretherketone (PEEK). Providing the output through hole in a separate tube may be easier and may help to provide an output through hole with the required dimensions while avoiding deformation or damage to the nozzle.

[0014] The nozzle may further comprise a holder extending between an open proximal end and an open distal end. The holder may comprise a proximal internal channel configured to receive the fluid transportation tube and a distal internal channel configured to receive the nozzle output tube. Providing a holder with internal channels may facilitate assembling the nozzle.

[0015] The holder may further comprise a middle internal channel connecting the proximal internal channel with the distal internal channel in some examples. The middle internal channel may be formed between a first wall and a second wall, the first wall being configured as a stop for the fluid transportation tube and/or the second wall being configured as a stop for the nozzle output tube. Fluid connection between the fluid transportation tube and the output through hole of the nozzle output tube may therefore be provided while the fluid transportation tube and the nozzle output tube may be retained in the nozzle.

[0016] A channel should be herein understood as an enclosed passage. Therefore, when reference to a diameter of a channel is made, a diameter of the passage, and therefore an internal diameter, is being referred to.

[0017] Optionally, the nozzle may further comprise a nozzle output tube retainer surrounding at least a distal portion of the holder. The output tube retainer may have a flange protruding beyond the open distal end of the holder and preventing the nozzle output tube to move out of the distal internal channel of the holder. Retention of the nozzle output tube may accordingly be further increased.

[0018] A nozzle as described herein may be used in combination with any suitable aerosol head and any suitable aerosol container.

[0019] In a further aspect of the present disclosure, a head for an aerosol container is provided. The head comprises a base configured to be coupled to the aerosol container, wherein the base comprises an outlet portion. The base further comprises a nozzle according to any of the examples described herein. The base further comprises a fluid transportation tube within the base. The fluid transportation tube extends through the outlet portion outside the base and into the nozzle.

[0020] The nozzle may be attached to the outlet portion of the base. This may help to reduce a risk of movement of the fluid transportation tube, for example if the tube is flexible. The precision and control of the spraying may be increased.

[0021] The fluid transportation tube may be flexible. A flexible tube can adapt its shape and maintain fluid communication when a user activates the aerosol.

[0022] The fluid transportation tube may be continuous. A continuous tube may reduce the risk of forming crystals in cryogenic applications. If two or more fluid transportation tubes are connected, e.g. through a connector, a risk of expansion of the fluid at junctions between the tubes which might lead to crystal formation may increase.

[0023] The aerosol head may further comprise an elastically deformable actuator. The deformable actuator may comprise a lever arm and a coupling portion integrally formed with the lever arm. The coupling portion may be configured to be mounted around the fluid transportation tube, an aerosol valve exit and a portion of an aerosol valve activator. The coupling portion may be configured such that when the lever arm is deformed by a user, the coupling portion acts on the valve activator of the aerosol container. Elastic deformation of the lever arm may therefore produce a downwards deformation/movement of the coupling portion that is mounted around the valve activator, thereby pressing directly or indirectly on the valve activator such that the propellant and the active ingredient housed within the aerosol container flow out the valve exit and through the fluid transportation tube. As the outlet portion forms part of the base of the head and as it is separately built with respect to the elastically deformable actuator and the fluid transportation tube, the outlet portion may not move when the coupling portion is deformed to actuate the valve activator. A static outlet portion may help to increase precision when spraying. A lever arm may provide for an easy handling of the aerosol head by the user, both for highly experienced and entry level health practitioners.

[0024] In yet a further aspect of the present disclosure, an aerosol dispenser is provided. The aerosol dispenser comprises a head according to any of the examples described throughout this disclosure and an aerosol container. The aerosol container comprises a valve assembly, the valve assembly comprising a valve exit and a valve activator for selectively opening a passage from an inside of the aerosol container to the valve exit.

[0025] Nozzles, heads and aerosol dispensers as described throughout this disclosure may be used, apart from in cryotherapy, in other medical or non-medical applications which include spraying with aerosol dispensers, and in particular where a narrow spray beam is required. For example, the nozzles, heads and aerosol dispenser as described herein may be applied in prophylactic treatments, cosmetic treatments and painting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] Non-limiting examples of the present disclosure are schematically illustrated in the appended drawings.

Figure 1A illustrates an axial cross-section of an example of a nozzle for a head for an aerosol container.

Figure 1B illustrates a zoom of a distal portion of the nozzle of figure 1A.

Figure 2 illustrates an axial cross-section of the holder of the nozzle of figure 1A.

Figure 3 illustrates a cross-sectional view of an example of an aerosol head.

Figure 4 illustrates a side view of the of an example of an aerosol head attached to an aerosol container.

Figure 5 illustrates a perspective frontal view of an example of an aerosol head.

Figure 6 illustrates a cross-sectional view of an example of an aerosol dispenser.

DETAILED DESCRIPTION OF EXAMPLES

[0027] In an aspect, a nozzle 1 which is suitable for spraying a fluid of an aerosol container 41 is provided. An example of a nozzle 1 is provided in figure 1A. Figure 1A is an example of an axial cross-section of a nozzle 1 for a head 40 for an aerosol container 41. The nozzle 1 is attached to an outlet portion 43 of a base 42 of head 40, and a fluid transportation tube 30, e.g. a flexible tube, extends through the nose and into the nozzle 1 in this figure. Although the nozzle is shown as attached to the outlet portion 43 of a base 42 of the head for an aerosol container 41, it should be noted that the nozzle 1 may be provided as a separate and standalone element. Figure 1B illustrates a zoom of a distal portion of the nozzle 1 of figure 1A.

[0028] The nozzle 1 comprises a proximal region 25 configured to receive a fluid transportation tube 30 which is configured to provide fluid communication with an aerosol container 41. The fluid transportation tube 30 may be flexible. The nozzle 1 further comprises a distal region 26 including an output through hole 16 (see figure 1B). The output through hole 16 has a diameter of, or less than, 0.15 mm, e.g. between 0.05 and 0.15 mm. In some examples, the diameter may be between 0.08 and 0.12 mm. The diameter may for example be about 0.1 mm. It should be understood that the diameter is always greater than 0, as there would be no through hole if its diameter is 0.

[0029] The output through hole 16 has a length between 2 and 6 mm, i.e. the diameter of between 0.05 and 0.15 (and specifically between 0.08 and 0.12, more specifically about 0.1 mm) extends over a length of 2 - 6 mm. In some examples, the length may be between 4 and 5 mm. The length may for example be about 4.4, 4.5 or 4.6 mm. The diameter may be measured in a radial direction 22 and the length may be measured in an axial direction 21 of the nozzle. A radial direction 22 may be understood as a direction which, in an axial cross-section, is perpendicular to the axial direction 21.

[0030] A fluid to be sprayed therefore travels through the output through hole 16 of the nozzle and exits the nozzle 1 through a distal end of the nozzle. The dimensions, i.e. the diameter and the length, of the output trough hole 16 may provide a narrower spray beam over an increased spray length (i.e. a distance after leaving the through hole) than in the prior art. Increased lengths of such a small diameter of the output through hole 16 are associated with a higher pressure drop and reduced lengths are associated with a less concentrated beam. The selected range of lengths, in combination with the indicated diameters, give narrow spray beams which allow a precise treatment of e.g. a skin lesion and reduce spillage.

[0031] In the example of figure 1A, the nozzle extends between an open proximal end 27 and an open distal end 28. The nozzle 1 comprises a nozzle output tube 20. The nozzle output tube 20 is inserted in the distal region 26 and has the output through hole 16 of the precise dimensions mentioned before. Using a separate nozzle output tube 20 for providing the output through hole 16, and then inserting the nozzle output tube 20 into the nozzle, e.g. into a holder 10, has been found to be an efficient manufacturing and assembly method to provide a output through hole 16 of desired dimensions.

[0032] In some examples, the nozzle output tube 20 may be made of, or may comprise, polyetheretherketone (PEEK). The nozzle output tube 20 may be an extruded PEEK tube. This material may particularly facilitate the provision of an output through hole 16 with the diameter and length mentioned before. Prior art attempts to provide small diameter through-holes of significant length with drilling and molding were unsuccessful.

[0033] The nozzle of the example of figure 1A also comprises a holder 10. The holder 10 extends between an open proximal end 3 and an open distal end 6, see figure 2. The holder 10 includes a proximal region 31 configured to receive a fluid transportation tube 30, e.g. a flexible tube, configured to provide fluid communication with the aerosol container 41. The holder 10 also includes a distal region 32. The distal region 32 may be configured to receive the nozzle output tube 20. The open proximal end 3 and the open distal end 6 of the holder 10 may be an open proximal end 27 and an open distal end 28 of the nozzle 1 in some examples.

[0034] In the example of figure 1A, the holder 10, and therefore the nozzle 1, are elongated in the axial direction 21. Herein elongated may refer to the fact that an external diameter of an element, e.g. the nozzle, is smaller, and particularly significantly smaller, than a length of the element. In other examples, a length of the nozzle or the holder may not need to be longer than an external diameter of the nozzle or the holder, respectively. The holder and the nozzle may in some examples have substantially circular radial cross-sections. In other examples, the holder and the nozzle may have a radial cross-section with a different shape, e.g. a squared, triangular or other radial cross-sectional shape.

[0035] The holder 10 surrounds the nozzle output tube 20. The distal region 26 of the elongated holder 10 may in some examples clamp or press against at least a portion of the nozzle output tube 20, e.g. against a proximal portion of the nozzle output tube 20. In these or other examples, an adhesive may be present between the nozzle output tube 20 and an internal wall of the distal region of the holder.

[0036] The axial 21 and radial 22 directions of the nozzle and the holder correspond to axial 21 and radial 22 directions of the nozzle output tube 20. The nozzle output tube may have substantially circular radial cross-sections. In other examples, the holder 10 may have a different radial cross-section, e.g. a squared, triangular or other radial cross-section.

[0037] Figure 2 illustrates an axial cross-section of the holder 10 of the nozzle 1 of figure 1A. In some examples, the holder 10 comprises a proximal internal channel 2 configured to receive the fluid transportation tube 30. The proximal internal recess 2 may be provided in the proximal region 31 of the holder 10. The proximal internal channel 2 may extend between the open proximal end 3 and a first internal wall 4 of the holder 10. The first wall 4 of the holder 10 may be configured as a stop for the fluid transportation tube 30. E.g., the tube 30 may be inserted into and through the proximal internal channel 2 until it touches the first wall 4 and cannot keep moving in the axial direction 21. The first wall 4 may be substantially perpendicular to the axial direction 21 in some examples.

[0038] A diameter of the proximal internal channel 2 may be about an external diameter of an envisaged fluid transportation tube 30. In some examples, the proximal internal channel 2 may slightly taper towards the first wall 4. For instance, the internal wall delimiting the proximal internal channel 2 may be inclined at an angle between 0.3 and 0.7 °, e.g. about 0.5 ° with respect to the axial direction 21. This tapering may help to keep the fluid transportation tube 30 in a desired position, e.g. inside the proximal internal channel 2 and against the first wall 4. One, two or more internal radial protrusions 23, provided e.g. close to the proximal end 3, see figure 2, may ease detaching the holder 10 from an injection mold. The internal radial protrusions 23 may also help to keep the fluid transportation tube 30 in place in some examples. The example of figure 3 shows two internal protrusions 23 extending radially.

[0039] An inside of the proximal end portion 31 of the holder 10 may widen towards the proximal end 3 of the holder 10. This may facilitate the introduction of the fluid transportation tube 30 inside the proximal internal channel 2. A length 24 of the proximal internal channel 2 may be between 20 and 30 mm in some examples. For example, the proximal internal channel may have a length of about 25 mm. Lengths smaller than 20 mm and lengths larger than 30 mm are possible in other examples. In examples where the holder 10 is attached to a base of the head 42 for an aerosol container 41, a smaller or a larger length of a proximal internal channel 2 may e.g. be selected depending on an expected distance between a skin lesion to be treated and an aerosol base of the head 42 in some examples.

[0040] The holder 10 may further comprise a distal internal channel 5 configured to receive the nozzle output tube 20. The distal internal channel 5 may extend between the open distal end 6 of the holder 10 and an internal second wall 7 of the holder. The second wall 7 may act as a stop for the nozzle output tube 20 inside the distal internal channel 5. E.g. the nozzle output tube 20 may be inserted into and through the distal internal channel 5 until it touches the second wall 7 and cannot keep moving in the axial direction 21. The second wall 7 of the holder may be substantially perpendicular to an axial direction 21 in some examples.

[0041] A diameter of the distal internal channel 5 may be about an external diameter of a nozzle output tube 20. In some examples, the distal internal channel 5 may slightly taper towards the distal end 6 of the holder 10. For instance, the distal internal channel 5 may have a diameter of 1.5 mm at its proximal end, and it may have a diameter of 1.6 or 1.7 mm at its distal end. This tapering may help to keep the nozzle output tube 20 in a desired position, e.g. inside the distal internal channel 5 and against the second wall 7. A length 58 of the distal internal channel 5 may be between 2 and 6 mm in some examples, for instance between 4 and 5 mm.

[0042] The holder 10 may further comprise a middle internal channel 11 connecting the proximal internal channel 2 with the distal internal channel 5. When the nozzle output tube 10 is inserted into the distal internal channel 5, the middle internal channel 11 connects the proximal internal channel 2 with the output through hole 16 of the nozzle output tube 20. When the fluid transportation tube 30, e.g. a flexible tube, is arranged inside the proximal internal channel 2, a fluid may advance through the fluid transportation tube 30 and then through the middle internal channel 11 and the output through hole 16. The middle internal channel 11 may be provided in a middle portion of the nozzle 33. A middle portion may be understood as a portion between, e.g. bridging, the proximal portion 31 and the distal portion 32.

[0043] The middle internal channel 11 may have a diameter between 0.2 and 0.9 mm, for example about 0.8 mm in some examples. In other examples, the middle internal channel 11 may have a diameter between 0.2 and 0.4 mm, e.g. about 0.3 or about 0.4 mm. The diameter of the middle internal channel 11 and the internal diameter of the fluid transportation tube 30 may be substantially the same in examples. Having a diameter of the middle internal channel 11 and an internal diameter of the fluid transportation tube between 0.2 and 0.4 mm may, in combination with the dimensions of the output through hole 16 of the nozzle 1, give a particularly good narrow spray beam while reducing the amount of fluid taken from the aerosol container 41. Similar or equal internal diameters of the fluid transportation tube 30 and the middle internal channel 11 may also reduce a risk of crystal formation between the fluid transportation tube 30 and the middle internal channel 11. In some examples, a length of the middle internal channel 11 may be between 2 and 6 mm, e.g. between 2.5 and 4 mm.

[0044] In some examples, a diameter of the middle internal channel 11 may be between 1.5 and 4 times larger, e.g. twice or three times larger, than a diameter of the output through hole 16. Such a ratio may allow to reduce an amount of the fluid inside the aerosol container 41 used and at the same time that a more precise beam is obtained. Therefore, the number of times that the fluid may be sprayed may be increased. For example, if an aerosol dispenser is to be used to treat skin warts, more doses of treatment may be obtained for a given content of the aerosol dispenser.

[0045] In some examples, a middle internal channel 11 may be omitted. I.e., the proximal internal channel 2 may be adjacent to the output through hole 16 of the nozzle.

[0046] The holder 10 may be rigid. A non-flexible holder 10 may help to maintain the fluid transportation tube 30, e.g. a tube that is more flexible than the holder, in a specific position for spraying, e.g. once the nozzle is coupled to a base of the head 42 for an aerosol container 41. The direction of spraying may be better controlled. The holder 10 may be made of, or may include, polypropylene in some examples. Other plastics or materials which make the holder 10 relatively unbendable may also be used.

[0047] When the output through hole 16 is provided in the nozzle output tube 20, the nozzle 1 may further comprise a nozzle output tube retainer 35 surrounding at least a distal portion of the holder 10. As illustrated in the example of figure 1A, the nozzle output tube retainer 35 may also surround at least in part a middle portion of the holder 10. The middle portion of the holder 10 may step 39 radially inwards. A proximal end of the retainer 35 may extend until the step 39 formed by the holder 10. A stronger connection between the retainer 25 and the holder 10, and therefore a better securing of the nozzle output tube 20, may be obtained.

[0048] The nozzle output tube retainer 35 may be radially flush with a portion of the holder 10, see figure 1A. I.e., the retainer 35 and the holder 10 may form a substantially flat external surface along a length of the nozzle. This may facilitate and make more comfortable the introduction of the nozzle 1 into a body cavity, e.g. the mouth.

[0049] The retainer 35 may have a flange 36 protruding beyond the open distal end 6 of the holder 10 which prevents the nozzle output tube 20 to move out of the distal internal channel 5 of the holder 10. The flange 36 may protrude in an axial direction 21 and radially inwards, as it may be seen in figure 1B. Providing a retainer 35 may help to further secure the nozzle output tube 20 inside the distal internal channel 5.

[0050] The flange 36 may have a radial surface 37 facing the open distal end 6 of the holder 10, and this surface 37 may radially protrude a certain amount beyond the holder 10 for stopping the nozzle output tube 20. An amount that the radial surface 37 extends may be adjusted for suitable securing the nozzle output tube 20 and for avoiding interrupting a spray beam flow. The radial surface 37 may in some examples radially extend between 8 and 10 times less than an internal diameter of the distal internal channel 5.

[0051] The flange 36 may have an inner surface 38 extending away from the open distal end 6 of the holder 10. An angle between two opposed inner surfaces 38 of the flange may be between 45 and 75 °, e.g. between 55 and 65 °, e.g. about 60 °. This angle may be measured in an axial cross-section. These angles may avoid the interruption of the flow of the spray beam and may also reduce or avoid dripping.

[0052] The nozzle output tube retainer 35 may be joined to the holder 10 by ultrasonic welding. This way of joining both elements may provide a strong attachment between the retainer 35 and the holder 10. Other ways of joining them may be possible. For example, an adhesive may additionally or alternatively be used. In some examples, the flange 36 may be joined to the distal open end 6 of the holder 10, e.g. by ultrasonic welding. Providing an attachment at the distal open end 6 of the holder may further contribute to increasing the strength of the attachment.

[0053] In a further aspect of the disclosure, a head 40 for an aerosol container 41 is provided. Figure 3 illustrates a cross-sectional view of an example of an aerosol head 40. Figure 4 shows a side view of an example of an aerosol head 40. Figure 5 illustrates a perspective frontal view of an aerosol head 40. The head 40 is configured to be coupled to the aerosol container 41. The head 40 comprises a base 42, the base being configured to be coupled to the aerosol container 41. The base 42 further comprises an outlet portion 43. The head 40 further comprises a nozzle 1 as described herein. The head 40 further comprises a fluid transportation tube 30, e.g. a flexible tube, within the base 42. The tube 30 extends through the outlet portion 43 outside the base 42, and extends into the nozzle 1. The base 42 may be coupled to the aerosol container e.g. by snap-fitting or matching threads of a bottom portion 52 of the base 42.

[0054] As the fluid transportation tube 30 is configured to provide fluid communication between the aerosol container 41 and the output through hole 16 of the nozzle 1 having a particular diameter and a particular length, a fluid within the aerosol container 41 may be precisely sprayed. A narrower beam may be obtained with respect to other nozzles which have different dimensions of an output through hole 16.

[0055] In some examples, the nozzle 1 may be attached to the outlet portion 43 of the base 42, e.g. by ultrasonic welding. The nozzle 1 may have a proximal flange 44 to facilitating this or other ways of attachment. Other manners of attaching the nozzle 1 and the base 42 may be used in other examples. For instance, an adhesive, clamping or threaded coupling, e.g. using matching threads, may be used. Attachment may be fixed, i.e. non-releasable, or may be releasable. For example, matching treads provide a releasable attachment whereas ultrasonic welding provides a fixed attachment. Ultrasonic welding may provide a strong and durable attachment between the nozzle 1 and the base 42. Attaching the nozzle 1 to the outlet portion 43 of the base 42 may help to increase precision, as the position of the fluid transportation tube 30 may be better controlled. The movement and oscillation of the fluid transportation tube 30 may be reduced in this way. Attachment between the nozzle 1 and the outlet portion 43 of the base 42 may be through the distal end 3 of the holder 10 of the nozzle 1, e.g. through a proximal flange 44.

[0056] In other examples, a proximal region 25 of the nozzle 1 may be attached to the fluid transportation tube 30. For example, an inside wall of the holder 10 of the nozzle 1, e.g. an inside wall of the proximal internal channel 2, may be attached to the fluid transportation tube 30. Attachment may be fixed or may be releasable. An adhesive may for example be used to provide a fixed non-releasable attachment. In other examples, a tapering of the proximal internal channel 2 towards an output through hole 16 may be sufficient to secure the nozzle 1 to the fluid transportation tube 30. For example, an axial or inclined (with respect to the axial direction) internal wall of the proximal internal channel 2 may help to retain the fluid transportation tube 30 inside it. The holder 10 may be rigid. Movement of the fluid transportation tube 30 may further be limited and controlled with a non-bendable or barely bendable holder 10. Immobilization of the fluid transportation tube 30 may be achieved in some examples.

[0057] An inner diameter of the fluid transportation tube 30 and a diameter of the middle internal channel 11 may be substantially the same. This may help to avoid or at least reduce crystal formation between the distal end of the fluid transportation tube 30 and the first wall 4. This may also help to reduce an amount of the fluid inside the aerosol container 41 used each time sprayed is performed.

[0058] The head 40 may further comprise an elastically deformable actuator 50 for pressing directly or indirectly on a valve activator 45 of the aerosol container 41 such that the fluid therein, e.g. a propellant and an active ingredient, flows out through a valve exit 46 and through the fluid transportation tube 30 towards the output through hole 16 of the nozzle 1. The fluid transportation tube 30 may be a continuous tube, i.e. it may be integrally formed. A fluid transportation tube 30 having a single tube portion may help to reduce crystal formation.

[0059] The elastically deformable actuator 50 may comprise a lever arm 57 and a coupling portion 48 integrally formed with the lever arm 57. The coupling portion 51 may be configured to be mounted around the fluid transportation tube 30, the valve exit 46 and a portion of the valve activator 45. The coupling portion 51 may have a through hole 56 for the fluid transportation tube 30 to pass through. The coupling portion 48 may be configured such that when the lever arm 57 is deformed by a user, the coupling portion 48 acts on the valve activator 45 of the aerosol container 41, thereby opening the valve exit 46 and releasing the content of the aerosol container 41. The coupling portion 48 may comprise a downwards protrusion 54.

[0060] The base of the head 42 may comprise a removable top flange 49 in some examples. This may help to assemble the aerosol dispenser head 40. In other examples, the base of the head 42 may be integrally formed.

[0061] A disc 51 may be housed inside the base 42, in correspondence with a bottom portion 52 of the base 42, see figure 3. The disc 51 may be rotatable and may comprise an extension 53 for handling by a user, see figure 4. The disc 51 may comprise two or more steps having different heights, and the downwards protrusion 54 of the coupling portion 48 may be configured to contact any of the steps. The extension 53 of the disc 51 may allow to rotate the disc 51 inside the bottom portion 52 of the base of the head 42 and engage different steps of the disc 51. The lever arm 57 may be configured to be actuated by a user until the downwards protrusion 54 hits on one of the steps of the disc. The steps may therefore provide a limit to the downwards movement allowed to the coupling portion 48 and to the stroke that a user can make on the lever arm 57.

[0062] One step of the disc may have a height such that a downwards movement of the downwards protrusion 54 of the coupling portion 48 is prevented and the lever arm 57 may therefore not be actuated. This step may be referred to as "security step" or "off step". A step having a height such that the lever arm 57 can be actuated may be referred to as "on step". The disc 51 may for example have an "on step" and an "off step" in some examples. In further examples, further intermediate steps may be incorporated.

[0063] Note that in the cross-sectional view of figure 3, the extension 53 has been rotated out of the plane of the cross-section and is therefore not visible in this particular view.

[0064] In examples, the body of the head, the top flange 49 and/or the disc 51 may be made e.g. from a polypropylene (PP) such as Bormed™ HD810MO, commercially available from Borealis. The flexible tube may be made from another polypropylene (PP) such as a PP commercially available from Raumedic -. The nozzle holder may be made e.g. from Bormed™ HD810MO as well. And the aerosol container or canister may be made from aluminum. The output through tube as mentioned before may be made from PEEK.

[0065] In a further aspect of the disclosure, an aerosol dispenser 47 is provided. Figure 6 illustrates a cross-sectional view of an example of an aerosol dispenser. The aerosol dispenser comprises an aerosol container 41 and an aerosol head 40 according to any of the examples described herein.

[0066] The aerosol container 41 comprises a valve assembly 55. The valve assembly 55 comprises a valve activator 45 with a valve exit 46 for selectively opening a passage from an inside of the aerosol container to the valve exit 46. In some examples (like the illustrated example), the valve activator 45 may be a stem that is pressed upwards (to a closed position) by a spring. Below the valve activator 45, a dip tube may be provided. Upon moving the valve activator 45 downwards, the spring may be compressed and a passage from a dip tube towards the valve exit 46 may be opened. In general, any suitable valve activator 45 may be used. The aerosol container may comprise norflurane in some examples, e.g. as propellant.

[0067] In further examples other valves with other valve activators might be used.

[0068] In further examples, different compositions may be used in combination as propellant and as active ingredient, in particular any composition or mix of compounds that is suitable for use in cryotherapy. In examples, the composition may comprise liquid nitrogen as active ingredient and/or propellant. In further alternatives, compositions comprising dimethyl ether, propane and/or isobutene may be foreseen.

[0069] The combination of the relatively narrow and long output through tube, and the coupling to the valve assembly 55 has been found to produce a pleasant "stop" sound for patients after use. The propellant and active ingredient that is between the valve assembly 55 and the outlet of the nozzle may flow back and escape around the valve assembly 55 when spraying is stopped, producing a slight sound indicating that operation has been stopped.

[0070] This written description uses examples to disclose a teaching, including the preferred embodiments, and also to enable any person skilled in the art to put the teaching into practice, including making and using any devices or systems and performing any incorporated methods. The patentable scope is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims. Aspects from the various embodiments described, as well as other known equivalents for each such aspects, can be mixed and matched by one of ordinary skill in the art to construct additional embodiments and techniques in accordance with principles of this application. If reference signs related to drawings are placed in parentheses in a claim, they are solely for attempting to increase the intelligibility of the claim, and shall not be construed as limiting the scope of the claim.

Claims

1. A nozzle (1) for spraying a fluid of an aerosol container (41), the nozzle (1) comprising:

a proximal region (25) configured to receive a fluid transportation tube 30 which is configured to provide fluid communication with the aerosol container (41);
a distal region (26) comprising an output through hole (16), the output through hole (16) having a diameter of, or less than, 0.15 mm, and having a length between 2 and 6 mm.

2. The nozzle of claim 1, wherein the output through hole (16) has a diameter between 0.05 and 0.15 mm, in particular between 0.08 and 0.12 mm.

3. The nozzle of claim 1 or claim 2, further comprising a nozzle output tube (20), the nozzle output tube (20) including the output through hole (16) and being inserted in the distal region (26).

4. The nozzle of claim 3, wherein the nozzle output tube (20) comprises, or is made of, polyetheretherketone.

5. The nozzle of claim 3 or claim 4, further comprising a holder (10) extending between an open proximal end (3) and an open distal end (6), the holder (10) comprising:

a proximal internal channel (2) configured to receive the fluid transportation tube (30); and
a distal internal channel (5) configured to receive the nozzle output tube (20).

6. The nozzle of claim 5, wherein the holder (10) further comprises a middle internal channel (11) connecting the proximal internal channel (2) with the distal internal channel (5).

7. The nozzle of claim 6, wherein the middle internal channel (11) is formed between a first wall (4) and a second wall (4), wherein the first wall (4) is configured as a stop for the fluid transportation tube (30) and/or the second wall (7) is configured as a stop for the nozzle output tube (20).

8. The nozzle of claim 6 or claim 7, wherein the middle internal channel (11) has a diameter between 0.2 and 0.9 mm.

9. The nozzle of any of claims 5-8, wherein the nozzle (1) further comprises a nozzle output tube retainer (35) surrounding at least a distal portion of the holder (10), the output tube retainer (35) having a flange (36) protruding beyond the open distal end (6) of the holder (10) and preventing the nozzle output tube (20) to move out of the distal internal channel (5) of the holder (10).

10. A head (40) for an aerosol container (41), the head (40) comprising:

a base (42) configured to be coupled to the aerosol container (41), the base (42) comprising an outlet portion (43);
a nozzle (1) according to any of claims 1 to 11 connected to the base (42);
a fluid transportation tube (30) within the base (42) that extends through the outlet portion (43) outside the base (42) and into the nozzle (1).

11. The head of claim 10, wherein a diameter of the middle internal channel (11) and an internal diameter of the fluid transportation tube (30) are substantially the same.

12. The head of claim 10 or claim 11, wherein the nozzle (1) is attached to the outlet portion (43) of the base (42).

13. The head of any of claims 10 - 12, wherein the fluid transportation tube (30) is flexible and/or continuous.

14. The head of any of claims 10 -13, further comprising an elastically deformable actuator (50) comprising:

a lever arm (57); and
a coupling portion (48) integrally formed with the lever arm (57) and configured to be mounted around the fluid transportation tube (30), an aerosol valve exit (46) and a portion of an aerosol valve activator (45);
wherein the coupling portion (48) is configured such that when the lever arm (57) is deformed by a user, the coupling portion (48) actuates on the valve activator (45) of the aerosol container (41).

15. An aerosol dispenser comprising:

a head (40) according to any of claims 12 - 14; and
an aerosol container (41) comprising a valve assembly (55), the valve assembly (55) comprising a valve exit (46) and a valve activator (45) for selectively opening a passage from an inside of the aerosol container (41) to the valve exit (46).

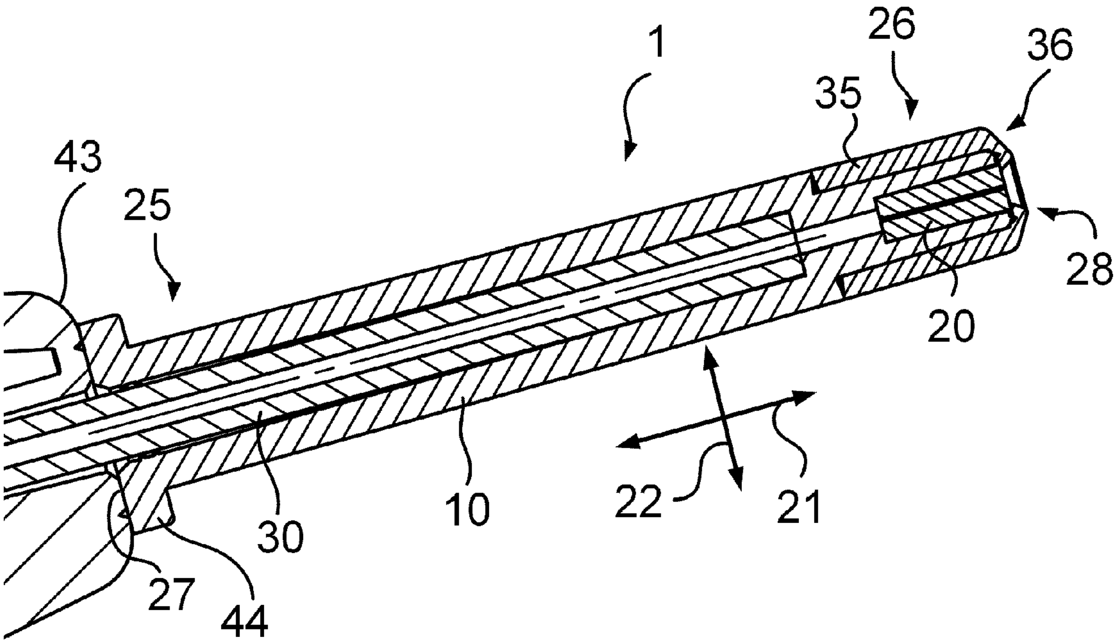

Fig. 1A

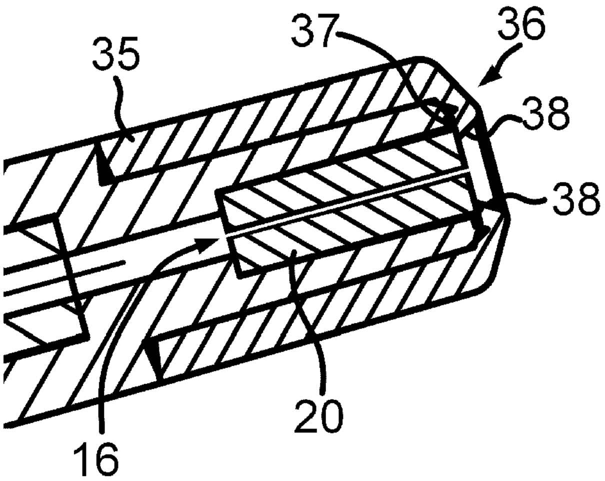

Fig. 1B

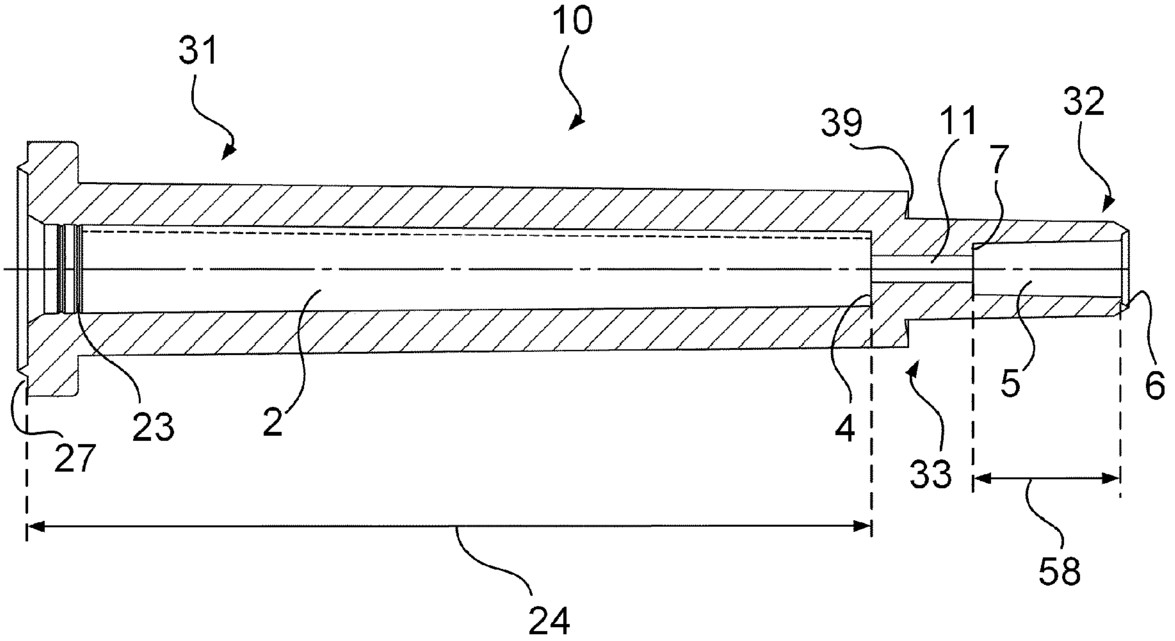
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Fig. 2

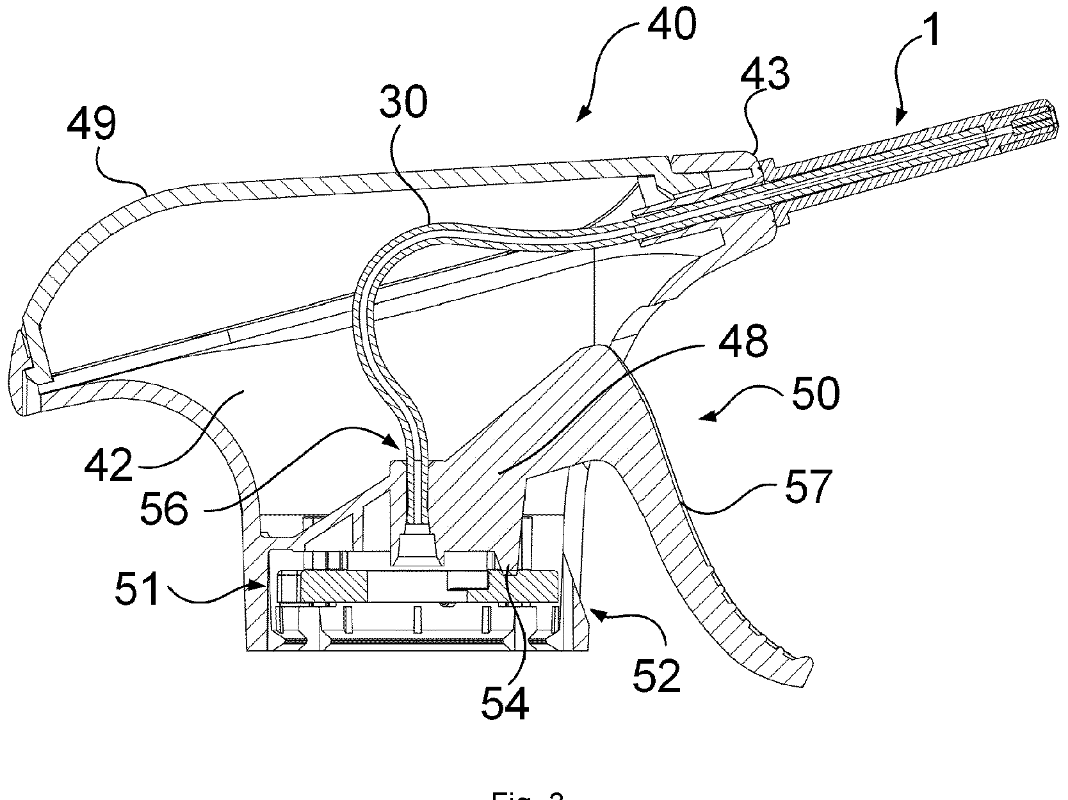
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Fig. 3

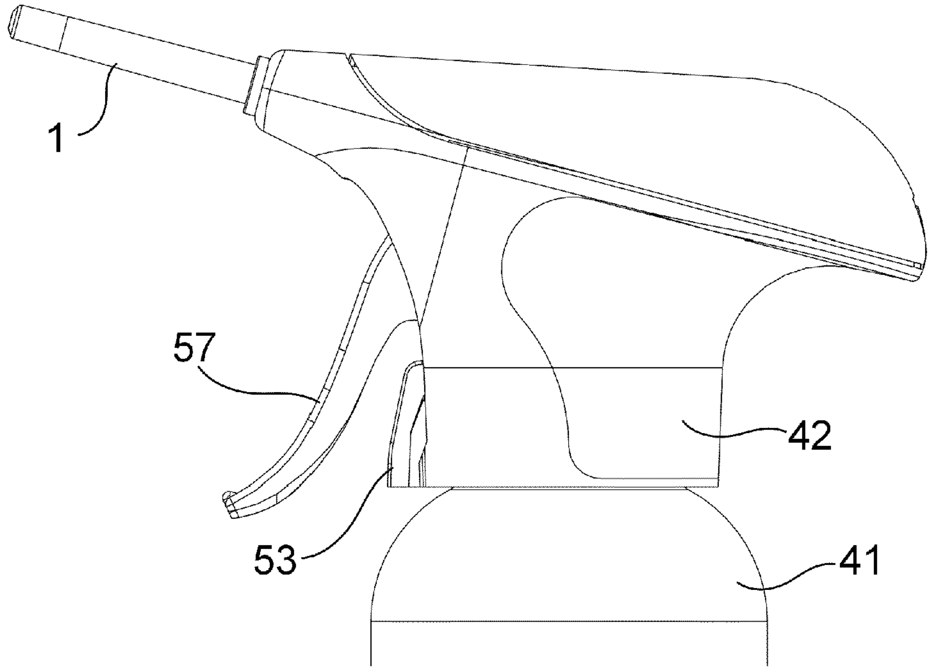

Fig. 4

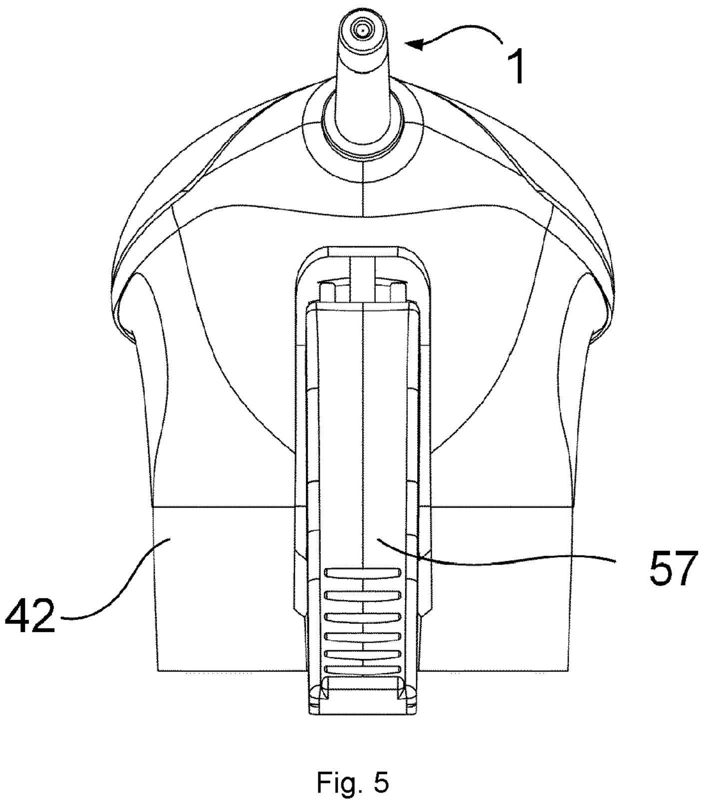

Fig. 5

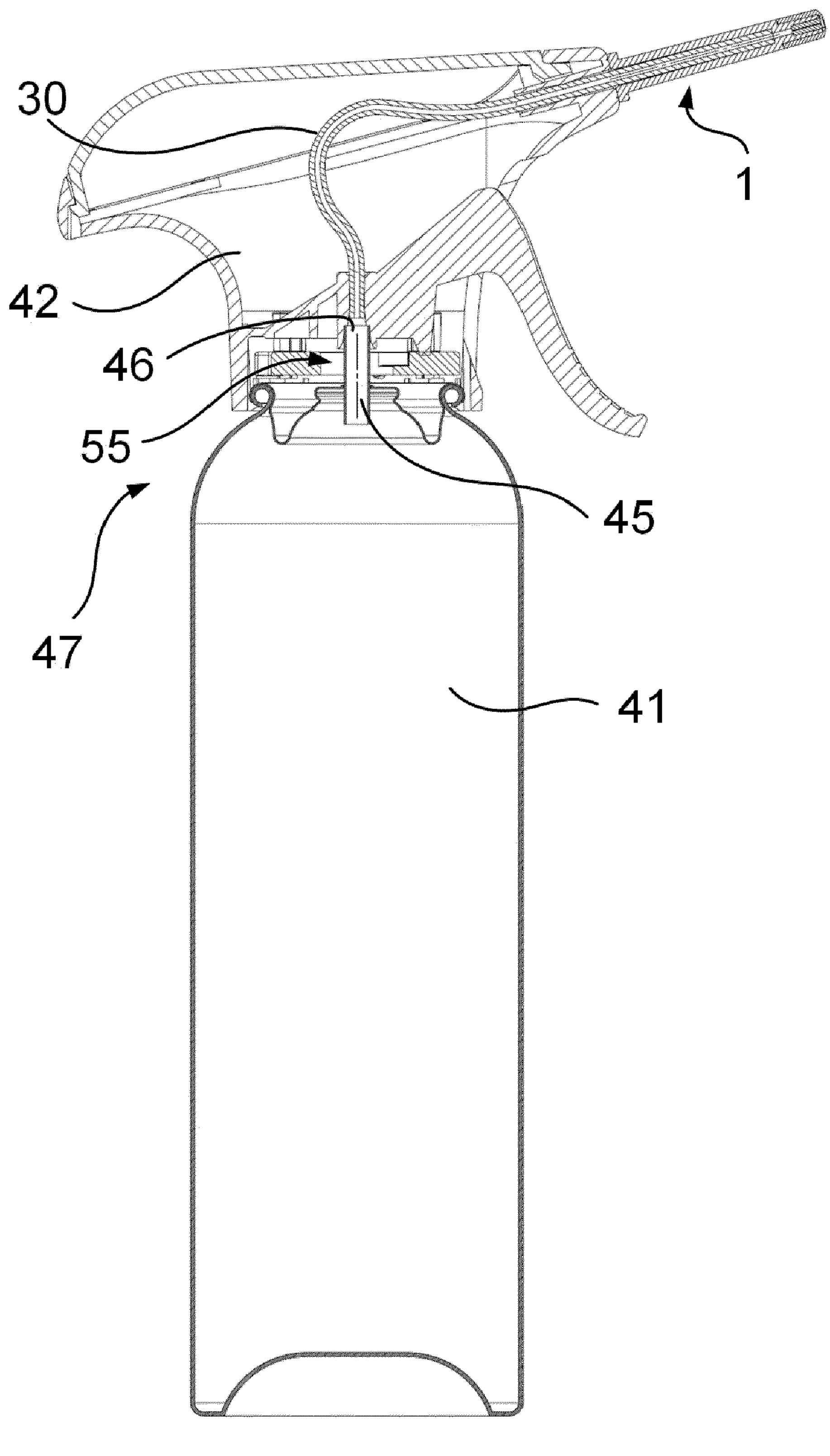

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 22 16 3325

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2011/011899 A1 (YEATES DONOVAN B [US]) 20 January 2011 (2011-01-20) * the whole document * -----	1,2	INV. B65D83/00
X	US 2019/322442 A1 (THOMSEN MARTIN [DK]) 24 October 2019 (2019-10-24) * the whole document * -----	1,2	

TECHNICAL FIELDS SEARCHED (IPC)
B65D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	11 July 2022	Eberwein, Michael

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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11-07-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011011899 A1	20-01-2011	US 2011011899 A1	20-01-2011
		US 2014332601 A1	13-11-2014
US 2019322442 A1	24-10-2019	DK 3339212 T3	10-05-2021
		EP 3339212 A1	27-06-2018
		ES 2877525 T3	17-11-2021
		US 2019322442 A1	24-10-2019
		WO 2018115447 A1	28-06-2018

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- WO 2018115447 A1 **[0006]**