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(54) Swirler nozzle assembly

(57) A swirler nozzle (100) includes a nozzle body (102) defining an inlet opening (104) and an outlet opening (106) in fluid communication with the inlet opening through a fluid passage (108) defined along a longitudinal axis (A). A swirler (110) includes a plurality of swirler legs (112) connected to the nozzle body proximate the outlet opening, with a swirl feature (114) supported from the swirler legs extending away from the outlet opening.

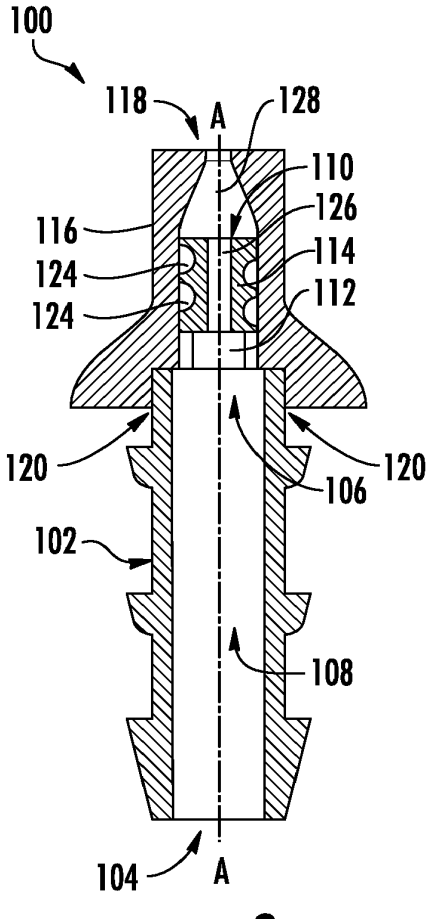

FIG. 2

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present disclosure relates to nozzles, and more particularly to swirler nozzles for issuing fluid in a spray pattern.

2. Description of Related Art

[0002] A variety of nozzles can be used to issue pressurized fluids. In certain applications it is desirable to issue a spray of discrete droplets from a nozzle, rather than a solid jet of liquid. For example, in fire extinguishers intended for safe use in environments that may include live electrical equipment, on which the extinguishers may inadvertently be used, it is necessary to have a nozzle that issues a spray of discrete droplets that cannot form an electrical path from the fire to the user.

[0003] Some nozzles include a main nozzle body and a cap with a separate swirler captured between the main nozzle body and cap to induce swirl on the liquid issuing from the nozzle body. The swirl enhances the breakup of the liquid into droplets. The swirler must be properly aligned and installed during assembly.

[0004] Such conventional methods and systems have generally been considered satisfactory for their intended purpose. However, there is still a need in the art for improved nozzles. The present disclosure provides a solution for this need.

SUMMARY OF THE INVENTION

[0005] A swirler nozzle includes a nozzle body defining an inlet opening and an outlet opening in fluid communication with the inlet opening through a fluid passage defined along a longitudinal axis. A swirler includes a plurality of swirler legs connected to the nozzle body proximate the outlet opening, with a swirl feature supported from the swirler legs extending away from the outlet opening.

[0006] It is contemplated that in certain embodiments the swirler and nozzle body are integral with one another. The swirler and nozzle body can each include a polymer material.

[0007] A cap can be mounted to the nozzle body, wherein a flow passage is defined between the swirler and the cap for imparting swirl onto fluids flowing through the cap to be sprayed from an outlet of the cap. The cap can include a polymer material and can be mounted to the swirler body at a weld joint.

[0008] The swirler can include two diametrically opposed legs with two opposed windows defined circumferentially between the legs. It is contemplated that the swirl feature can include a pair of channels forming a double helix winding along the longitudinal axis in a direction away from the outlet opening, wherein each channel is in fluid communication with a respective one of the windows for imparting swirl on fluids flowing from the outlet opening. A pair of flow passages can be defined between the swirler and the cap through the channels for imparting swirl onto fluids flowing through the cap to be sprayed from an outlet of the cap wherein each channel is in fluid communication with a respective one of the windows for imparting swirl on fluids flowing from the outlet opening. The swirl feature can include a centerline flow port defined on the longitudinal axis for issuing fluid along the longitudinal axis. It is also contemplated that a spin chamber can be defined downstream of the channels and between the swirler and the cap.

[0009] A method of assembling a swirler nozzle assembly includes forming a nozzle body defining an inlet opening and an outlet opening in fluid communication with the inlet opening through a fluid passage defined along a longitudinal axis, with a swirler connected to the nozzle body. Forming the nozzle body can include forming the nozzle body and swirler integrally. For example, forming the nozzle body can include integrally forming the nozzle body and swirler in a single molding process. The method can include mounting a cap to the nozzle body to form a flow passage between the swirler and the cap for imparting swirl onto fluids flowing through the cap to be sprayed from an outlet of the cap. Mounting the cap to the nozzle body can include ultrasonic welding the cap to the nozzle body.

[0010] These and other features of the systems and methods of the subject disclosure will become more readily apparent to those skilled in the art from the following detailed description of the preferred embodiments taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] So that those skilled in the art to which the subject disclosure appertains will readily understand how to make and use the devices and methods of the subject disclosure without undue experimentation, preferred embodiments thereof will be described in detail herein below with reference to certain figures, wherein:

Fig. 1 is a perspective view of an exemplary embodiment of a swirler nozzle constructed in accordance with the present disclosure, showing the nozzle body and the cap;

Fig. 2 is a cross-sectional side elevation view of the swirler nozzle of Fig. 1, showing the swirler within the cap;

Fig. 3 is a side-elevation view of the swirler body of Figs. 1 and 2, showing the swirler extending from the nozzle body; and

Fig. 4 is a side-elevation view of the swirler body of Fig. 3, showing the swirler body rotated 90° about the longitudinal axis to show both of the legs of the swirler.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] Reference will now be made to the drawings wherein like reference numerals identify similar structural features or aspects of the subject disclosure. For purposes of explanation and illustration, and not limitation, a partial view of an exemplary embodiment of a swirler nozzle in accordance with the disclosure is shown in Fig. 1 and is designated generally by reference character 100. Other embodiments of swirler nozzles in accordance with the disclosure, or aspects thereof, are provided in Figs. 2-4, as will be described. The systems and methods described herein can be used to produce sprays of discrete droplets, and to provide for simplified assembly.

[0013] Swirler nozzle 100 includes a nozzle body 102 and a cap 116, which has a discharge outlet 118 for spaying liquids. With reference to Fig. 2, nozzle body 102 defines an inlet opening 104 and an outlet opening 106 in fluid communication with inlet opening 104 through a fluid passage 108 defined along longitudinal axis A. A swirler 110 includes a pair of swirler legs 112 connected to nozzle body 102 proximate outlet opening 106. Referring to Fig. 4, legs 112 straddle outlet opening 106 so that a swirl feature 114 supported from the swirler legs 112 can extend away from and span across outlet opening 106. While swirler 110 is shown and described with two legs 112, it is also contemplated that any other suitable number of legs can be used. For example, the number of legs can be more than two, with the number of windows 122, described below, equivalent to the number of legs.

[0014] It is contemplated that in certain embodiments the swirler 110 and nozzle body 102 are integral with one another. For example, swirler 110 and nozzle body 102 can each include a polymer material, and can be formed integrally together in a single molding process. In this manner, misassembly of swirler 110 into swirler nozzle 100 can be largely or completely avoided.

[0015] Referring again to Fig. 2, cap 116 is mounted to the nozzle body 102 with a flow passage defined between swirl feature 114 and cap 116 for imparting swirl onto fluids flowing through cap 116 to be sprayed from outlet 118. Cap 116 can include a polymer material and can be mounted to swirler body 102 at a weld joint 120. It is also contemplated that any other suitable manner of engaging cap 116 to swirler body 102 can be used, such as a threaded engagement.

[0016] With reference to Figs. 3 and 4, the two diametrically opposed legs 112 of swirler 110 define two opposed windows 122 circumferentially between the legs 112. Swirl feature 114 includes a pair of channels 124 forming a double helix winding along the longitudinal axis A in a direction away from outlet opening 106. Each channel 124 is in fluid communication directly with a respective one of the windows 122 for imparting swirl on fluids flowing from outlet opening 106. A pair of flow passages are defined between the swirler 110 and the cap 116 through the channels 124 for imparting swirl onto fluids flowing through cap 116 to be sprayed from outlet 118 of the cap. Each of the two channels is in fluid communication with a respective one of the windows 122 for feeding fluids flowing from outlet opening 106 into channels 124. The swirl feature 114 also includes a centerline flow port 126 defined on the longitudinal axis A for issuing fluid along the longitudinal axis A. A spin chamber 128 is defined downstream of the channels 124 and between swirler 110 and cap 116.

[0017] Pressurized fluid at inlet opening 104 can flow through fluid passage 108 and outlet opening 106, through windows 122 into channels 124 and centerline flow port 126. After passing through channels 124 and centerline flow port 126, the flow swirls in spin chamber 128 and finally sprays out discharger orifice 118 as a spray of liquid droplets.

[0018] An exemplary method of assembling swirler nozzle 100 includes forming swirler 110 and nozzle body 102 together integrally as a single polymer workpiece in a single molding process. Cap 116 can be formed of the same or a similar polymer material in a separate molding process, and can then be ultrasonically welded to the end of nozzle body 102 proximate outlet opening 106. Since swirler 110 and nozzle body 102 are integrally connected, the chances of the final assembly having a misassembled swirler 110 are greatly reduced or eliminated.

[0019] The methods and systems of the present disclosure, as described above and shown in the drawings, provide for swirler nozzle assemblies with superior properties including ease of manufacture. While the apparatus and methods of the subject disclosure have been shown and described with reference to preferred embodiments, those skilled in the art will readily appreciate that changes and/or modifications may be made thereto without departing from the spirit and scope of the subject disclosure.

Claims

1. A swirler nozzle assembly (100) comprising:

   a nozzle body (102) defining an inlet opening (104) and an outlet opening (106) in fluid communication with the inlet opening through a fluid passage (108) defined along a longitudinal axis (A); and
   a swirler (110) including a plurality of swirler legs (112) connected to the nozzle body proximate the outlet opening, with a swirl feature (114) supported from the swirler legs extending away from the outlet opening.

2. A swirler nozzle as recited in claim 1, wherein the swirler and nozzle body are integral with one another.

3. A swirler nozzle as recited in claim 1 or 2, wherein the swirler and nozzle body each include a polymer material.

4. A swirler nozzle as recited in claim 1, 2 or 3, further comprising a cap (116) mounted to the nozzle body, wherein a flow passage is defined between the swirl feature and the cap for imparting swirl onto fluids flowing through the cap to be sprayed from an outlet of the cap.

5. A swirler nozzle as recited in claim 4, wherein the cap includes a polymer material and is mounted to the swirler body at a weld joint.

6. A swirler nozzle as recited in any preceding claim, wherein the swirler includes two diametrically opposed legs (112) with two opposed windows (122) defined circumferentially between the legs.

7. A swirler nozzle as recited in claim 6, wherein the swirl feature includes a pair of channels (124) forming a double helix winding along the longitudinal axis in a direction away from the outlet opening, wherein each channel is in fluid communication with a respective one of the windows for imparting swirl on fluids flowing from the outlet opening.

8. A swirler nozzle as recited in claim 1, 2 or 3, wherein the swirler includes two diametrically opposed legs (112) with two opposed windows (122) defined circumferentially between the legs, wherein the swirl feature includes a pair of channels (124) forming a double helix winding along the longitudinal axis in a direction away from the outlet opening, wherein the nozzle assembly further comprises a cap (116) mounted to the nozzle body with a pair of flow passages defined between the swirl feature and the cap through the channels for imparting swirl onto fluids flowing through the cap to be sprayed from an outlet of the cap wherein each channel is in fluid communication with a respective one of the windows for imparting swirl on fluids flowing from the outlet opening.

9. A swirler nozzle as recited in claim 7 or 8, wherein a spin chamber (128) is defined downstream of the channels and between the swirler and the cap.

10. A swirler nozzle as recited in any preceding claim, wherein the swirl feature includes a centerline flow port (126) defined on the longitudinal axis for issuing fluid along the longitudinal axis.

11. A method of assembling a swirler nozzle assembly (100) comprising forming a nozzle body (102) defining an inlet opening (104) and an outlet opening (106) in fluid communication with the inlet opening through a fluid passage (108) defined along a longitudinal axis (A), with a swirler (110) connected to the nozzle body.

12. A method as recited in claim 11, wherein forming the nozzle body includes forming the nozzle body and swirler integrally.

13. A method as recited in claim 11 or 12, wherein forming the nozzle body includes integrally forming the nozzle body and swirler in a single molding process.

14. A method as recited in claim 11, 12 or 13, further comprising mounting a cap (116) to the nozzle body to form a flow passage between the swirler and the cap for imparting swirl onto fluids flowing through the cap to be sprayed from an outlet of the cap.

15. A method as recited in claim 14, wherein mounting the cap to the nozzle body includes ultrasonic welding the cap to the nozzle body.

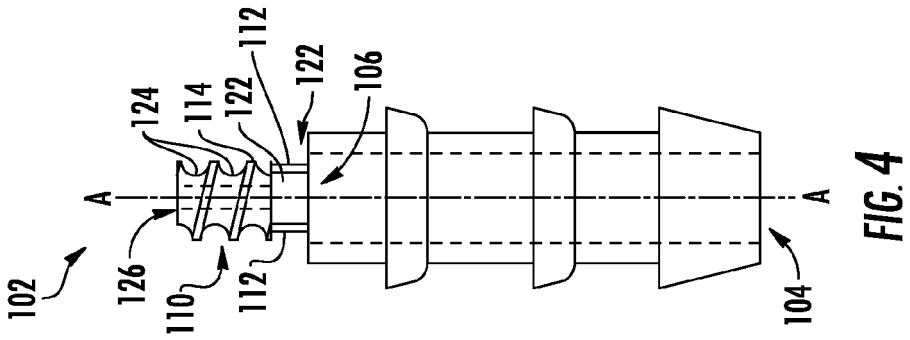

FIG. 4

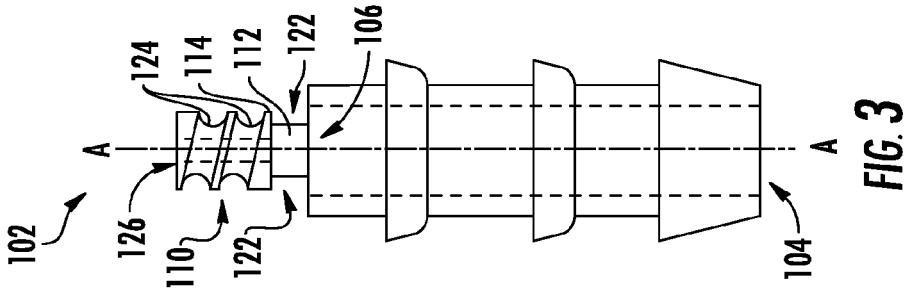

FIG. 3

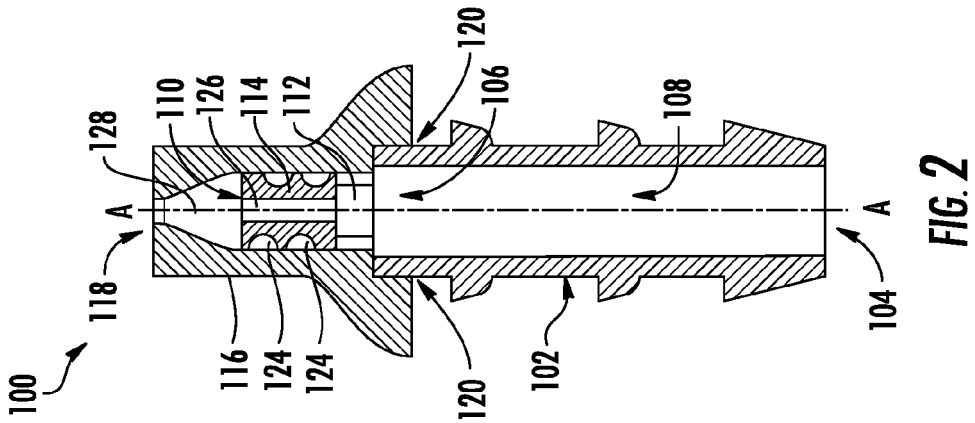

FIG. 2

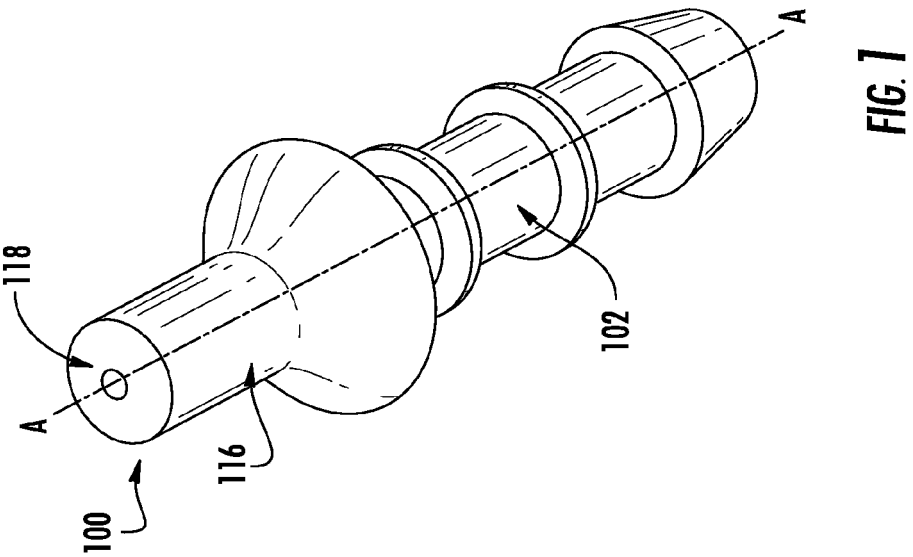

FIG. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 9337

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 2012/073043 A1 (JAWORSKI JEFFERY S [US] ET AL) 29 March 2012 (2012-03-29) * paragraph [0057] * * paragraphs [0060] - [0066] * * figures 15-23 *	1-15	INV. A62C31/02 B05B1/34
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A	US 5 267 692 A (MAAS WILHELMUS J J [NL] ET AL) 7 December 1993 (1993-12-07) * column 4, line 59 - column 5, line 64 * * figures 1-6, 11 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) A62C B05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 October 2014	Zupancic, Gregor

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 16 9337

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27-10-2014

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