

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
9 April 2009 (09.04.2009)

PCT

(10) International Publication Number
WO 2009/043092 A1

(51) International Patent Classification:
F25C 3/04 (2006.01)

(74) Agent: GRIFFITH HACK; 509 St Kilda Road, Melbourne, Victoria 3004 (AU).

(21) International Application Number:
PCT/AU2008/001452

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(22) International Filing Date: 1 October 2008 (01.10.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2007905438 4 October 2007 (04.10.2007) AU

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant (*for all designated States except US*): BALLISTIC AUSTRALIA PTY LTD [AU/AU]; 126 End Street, Deniliquin, New South Wales 2710 (AU).

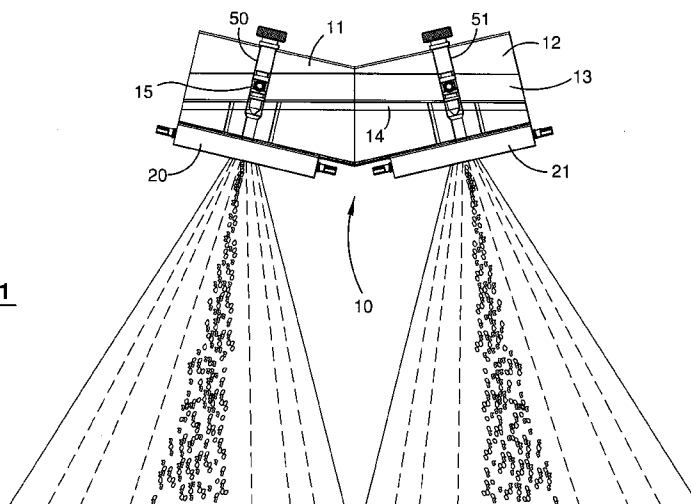
(72) Inventor; and

(75) Inventor/Applicant (*for US only*): DODSON, Mitchell Joe [AU/AU]; Lot 4 Simmonds Creek Road, Tawonga South, Victoria 3698 (AU).

Published:
— with international search report

(54) Title: SNOW MAKING EQUIPMENT

FIG. 1



(57) Abstract: A snow making gun comprising a manifold arranged to be coupled to a source of compressed air and a source of water, the manifold having a water conduit arranged to feed water to an adjustable flat jet nozzle having an outlet aperture, the manifold also including an air conduit, whereby air and water are arranged to be fed to a nucleator having an exit aperture positioned above the outlet orifice of the flat jet nozzle, an adjustable valve controlling flow of water to the nucleator, whereby in use, the nucleator projects ice particles above a flat plume of water droplets from the flat jet nozzle.

- 1 -

Title: Snow Making Equipment**Introduction**

This invention relates to snow making equipment and, in particular, a manifold for such equipment and an improved nucleator for use with this equipment. This invention also relates to improvements in adjustable flat jet nozzles.

Background of the Invention

In my earlier patent application, WO2004/087329, I disclosed the use of an adjustable flat jet nozzle in snow making equipment. This application relates to further improvements of this equipment as well as the design of an improved nucleator which can be used in combination with an adjustable flat jet nozzle.

The nucleators that are conventionally used in the snow making industry comprise a fixed orifice water nozzle fed from an air and water mixing chamber. The mixing chamber usually exits via a fixed orifice or sometimes to an interchangeably sized orifice. The efficiency and energy consumption of a snow making gun is based on compressed air usage. Thus the orifice diameters of nucleators are generally very small. This makes them very susceptible to blockage from debris. In order to combat blockage, various forms of filters are generally used. In the event of nozzle blockage, the nozzle must be removed and cleaned.

It is consideration of these issues that has brought about the present invention.

Summary of the Invention

According to a first aspect of the present invention, there is provided a snow making gun comprising a manifold arranged to be coupled to a source of compressed air and a

- 2 -

source of water, the manifold having a water conduit arranged to feed water to an adjustable flat jet nozzle having an outlet orifice, the manifold also including an air conduit whereby air and water are arranged to be fed
5 to a nucleator having an outlet aperture positioned above the outlet orifice of the flat jet nozzle, an adjustable valve controlling flow of water to the nucleator, whereby in use the nucleator projects ice particles above a flat plume of water droplets from the flat jet nozzle.

10 In accordance with a further aspect of the present invention there is provided a manifold for snow making equipment, the manifold comprising an adjustable nucleator positioned above an adjustable flat jet nozzle whereby the nucleator is arranged to be coupled to a source of
15 compressed air and both the nucleator and flat jet nozzle are arranged to be coupled to a source of water.

Preferably the nucleator comprises a converging-diverging nozzle with inlet and exit apertures, a mixing chamber for mixing air and water to be fed to the inlet of the nozzle
20 and an adjustable valve to control flow of water to the mixing chamber. Preferably the converging-diverging nozzle is interchangeable, each nozzle being of differing dimensions.

In accordance with a further aspect of the present
25 invention there is provided a nucleator for snow making comprising a mixing chamber adapted to be fed by a source of water and compressed air, a converging-diverging nozzle having an inlet and an outlet, the mixing chamber being arranged to feed an air/water mixture to the inlet of the
30 nozzle.

According to a still further aspect of the invention there is provided a nozzle for producing a flat spray pattern, the nozzle comprising a fluid passageway terminating in a

- 3 -

- cross member having an end wall having an outlet aperture, the cross member defining at least two deflectors that converge towards the aperture to deflect the fluid towards the aperture; the cross member supporting axially
- 5 displaceable pins adapted to move across the aperture to decrease or increase the cross section of the aperture, wherein the aperture is an elongate slit with walls diverging slightly outwardly from the centre of the aperture.
- 10 Preferably the ends of the pins are chamfered.

In one embodiment electrically driven linear actuators control the displacement of the pins.

Description of the Drawings

- Embodiments of the present invention will now be described
- 15 by way of example only with reference to the accompanying drawings in which:

Figure 1 is a plan view of a manifold for use in snow making equipment illustrating the superimposition of a plane of ice crystals with a plume of water;

- 20 Figure 2 is a side elevational view of the manifold again illustrating the superimposition;

Figure 3 is a plan view of the manifold illustrating a nucleator control valve;

- Figure 4 is a cut-away view of the manifold from the side
- 25 illustrating the nucleator;

Figure 5 is a perspective view of a convergent-divergent nozzle forming part of the nucleator;

Figure 6 is an exploded view of a water control valve;

- 4 -

Figure 7 is a front perspective view of the manifold illustrating the association of the nucleator and a flat jet nozzle;

Figure 8 is an exploded view of a flat jet nozzle;

5 Figure 9 is a front elevational view of the assembled flat jet nozzle;

Figure 10 is a sectional view taken from the rear of the flat jet nozzle; and

10 Figure 11 is a side elevational view of a pin used in the flat jet nozzle.

Description of the Preferred Embodiment

As shown in the accompanying drawings, snow making equipment includes a manifold 10, the manifold includes two adjustable flat jet nozzles 20 and 21, each having a
15 nucleator 50 and 51 positioned above the nozzles so that, in use, the nucleators form ice crystals that are projected in plumes above the flat plumes of water particles that are projected by the adjustable flat jet nozzles.

20 As shown in Figures 1 and 2, the manifold 10 comprises two machined metal blocks 11 and 12 that are joined end to end to form an obtuse angle so that the projecting plumes diverge from one another as shown in Figure 1. As shown in Figure 2, the nucleator 51 is positioned vertically
25 above the adjustable flat jet nozzle 21. Each block 11 and 12 has a common water port 13 and a separate common air port 14. Each end of each block 11, 12 is adapted to be connected to a source of water and air. Each block 11 and 12 also includes a machined transverse passage 15 that
30 extends from the rear to the front of the block and supports the nucleator 50, 51 which in turn comprises an

- 5 -

adjustable water valve 60 and a convergent-divergent nozzle 70. Each adjustable flat jet nozzle 20, 21 is housed in a rectangular block 22, details of which are described later. As shown in Figures 2 and 3, the common
5 water port 13 feeds both the nucleator 50, 51 and the flat jet nozzle 20, 21 and the air port 14 feeds the nucleator 50, 51. As shown in Figure 2, the nucleator terminates in an exit aperture 55 that is spaced vertically above the exit aperture 25 of the adjustable flat jet nozzle 21.
10 Furthermore, as shown in Figure 2, the exit aperture 25 of the flat jet nozzle 21 is positioned forwardly of the exit aperture 55 of the nucleator 51.

As shown in Figure 4, the nucleator 51 is housed in the passageway 15 of the manifold and includes a valve body 52
15 that is fixed into the passageway 15 and sealed therein by a pair of spaced O-rings 53, 54, the valve body 52 has a central throughway 56 which supports and elongate needle valve 57 that has one end with a tapered tip 58 and the other end connected to a knurled adjusting knob 59 that is
20 mounted externally of the manifold 10. The tip 58 of the needle valve 57 is axially displaceable relative to an aperture in the valve body 52 to provide an adjustable nozzle. This defines a mixing chamber in which air coming from the air port 14 in an annular manner enters the air
25 chamber to meet with water flowing down the centre of the valve and controlled by the needle jet 57. The water enters the valve by a transverse port 61 that is coupled to the water port 13. The mixing chamber communicates with the convergent-divergent mixing nozzle 70 which is
30 mounted in the block 12 to be replaceable so that mixing nozzles of different dimensions can be positioned in the nucleator. The mixing nozzle terminates in the exit orifice 55.

Details of the mixing nozzle 70 are shown in Figure 5
35 where the nozzle is housed in a cylindrical body 71 that

- 6 -

can be located in the throughway 15 and removed by accessing small spaced holes. The inlet tapers 74 down through a conical converging component to a narrow nucleator throat 75 with a cylindrical wall to then
5 conically taper outwardly to the exit orifice. The throat 75 to exit orifice 55 ratio is preferably between 1.5 to 1.85:1. This ratio is dependent on the operating pressure of the compressed air. The air consumption is dictated by the nucleator throat diameter.

10 Details of the valve body 52 and needle valve 57 are shown in greater detail with reference to Figure 6. This illustrates that the needle valve 57 has a threaded portion 63 that is able to screw into a similarly threaded recess 64 in the valve body 52 so that rotation of the
15 knurled knob 59 causes the valve tip 58 to move axially towards and away from the valve seat 65 defined by the end of the valve body 52. The needle and seat arrangement controls the amount of water that flows into the mixing nozzle. This design allows for a larger water exit
20 orifice which can be fully opened in the event of a blockage to permit the debris to pass through with subsequent return to a smaller opening size for normal operation.

The nucleator 50, 51 does not require removal from the manifold 10 to facilitate the cleaning of debris. The
25 control valve adjusts the volume of water entering the mixing nozzle 70. Mixing nozzles 70 of differing size may be interchanged into the manifold and the interchangeable mixing nozzles allow for a variance in the air consumption
30 and, combined with the adjustable water control valve, maintain the correct air to water ratio, thus in effect forming a variable nucleator.

The convergent-divergent nozzle 70 of the nucleator 50, 51 is designed to create a Laval effect accelerating the air

- 7 -

and water mixture to supersonic speeds. The Laval effect lowers the gas temperature to temperatures between -40°C to -90°C. This transforms the air and water mixture into ice crystals which are ejected at high speed into the variable
5 flat jet water plume. The ice crystals, which act as high temperature nucleators, seed the water droplets allowing the water droplets to give off their latent heat and convert to snow.

In my earlier patent application WO2004/087329 the
10 disclosure of which is incorporated herein by reference, I describe an adjustable flat jet nozzle in which a pair of axially aligned pins can be moved to and from each other across the mouth of an aperture to define a flat jet, characteristics of which can be adjusted by movement of
15 the pins. In WO2004/087323 the adjustable flat jet nozzle is in the form of a T piece with the water flowing down the leg of the T and the pins being axially displaceable across the arms of the T. The arms or cross member of the 'T' define at least two deflectors that converge towards
20 the aperture to deflect the water towards the aperture. The outlet aperture is a circular hole in the T piece and the pins have planar faces substantially perpendicular to the axes of the pins.

25 In the adjustable flat jet nozzle 100 shown in Figures 8 to 11 the outlet orifice has been replaced by an elongate slit 101 that diverges outwardly at the ends 102 and 103. This orifice 101 changes the water droplet size and they start small at the centre but gradually get larger towards
30 the ends 102, 103 of the orifice. The pins 104 and 105 are axially displaceable across the orifice 101 but instead of having the planar ends, the pins have chamfered ends 110 as shown in figure 11 in which a planar bevelled

- 8 -

edge 111, 112 is positioned on each side of the tip 113 of the pin 104 to meet at a point. The angle of the bevel being between 30°-45° off the transverse plane.

5 The divergence of the elongate orifice 101 is dependent on the width and length of the slit. As shown in Figure 10 the pins are driven by a threaded drive from drive shafts 120, 121 extending outwardly from either end of the nozzle housing. The design of the threaded coupling is such that
10 the pins 104, 105 can move from an open position at ends of the elongate orifice 101 to a closed position at the centre of the orifice.

It is understood that the drive mechanism which is the
15 same as the mechanism described in WO2004/087329 can be replaced by small linear actuators that would be attached to each pin 104, 105. The linear actuators are driven by a low voltage DC supply and displacement can be controlled to high tolerances to drive the pins 104, 105 back and
20 forth across the orifice 101.

The radii of the ends 102, 103 of the orifices 101 are the same. The minimum radius is dependent on the initial width of the orifice. As the chamfered pins 104, 105 pull
25 back they progressively open the orifice 101 so the slit grows in length and width. The width of the orifice 101 determines water particle size. This design results in smaller water droplets being produced when the pins 104, 105 are close together, with the droplets growing in size
30 as the pins move further apart. Smaller water droplets are desirable in marginal snow making conditions with progressively larger droplets being desirable as the air temperature continues to fall.

- 9 -

The spray angle of the variable flat jet nozzle is determined by the chamfer of the pins. Although the chamfer is described as being on both sides it is understood that a single chamfer on one side can be utilized. The chamfer also does not require a flat face with a variety of curves being envisaged. It is considered that the combination of the orifice opening width and the pin chamfer determines the spray angle.

10

The flat jet described above is specifically designed for use in association with snowmaking equipment. It is, known, understood that this nozzle is applicable to many fields totally unrelated to snowmaking. The nozzle has applicability in any industrial spraying application where there is a need for a variable flat jet nozzle, especially fire fighting.

The manifold described above can be used in a variety of snow making equipment such as on a sled which can be towed behind a snow mobile, onto an extruded mast or varying heights. It can be positioned on a rotating head or a fixed head again on a mast. It can be placed on top of a fan gun, or attached directly to a snow making water hydrant.

The combination of an adjustable flat jet nozzle and a nucleator of the kinds discussed above provide snow making equipment that operates at much lower energy consumption than conventional snow making equipment.

30

- 10 -

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1 A snow making gun comprising a manifold arranged to
be coupled to a source of compressed air and a source of
5 water, the manifold having a water conduit arranged to
feed water to an adjustable flat jet nozzle having an
outlet aperture, the manifold also including an air
conduit, whereby air and water are arranged to be fed to a
nucleator having an exit aperture positioned above the
10 outlet orifice of the flat jet nozzle, an adjustable valve
controlling flow of water to the nucleator, whereby in
use, the nucleator projects ice particles above a flat
plume of water droplets from the flat jet nozzle.

2 The snow making gun according to claim 1 wherein the
15 nucleator includes a converging-diverging nozzle with
inlet and exit apertures and a mixing chamber for mixing
air and water to be fed to the inlet of the converging-
diverging nozzle.

3 The snow making gun according to either claim 1 or 2
20 wherein the converging-diverging nozzle is
interchangeable, each nozzle being of differing
dimensions.

4 The snow making gun according to any one of the
preceding claims wherein the outlet aperture is an
25 elongate slit with walls diverging slightly outwardly from
the centre of the aperture.

5 The snow making gun according to any one of the
preceding claims wherein the adjustable flat jet nozzle
comprises a fluid passageway terminating in a cross member

- 11 -

having the outlet aperture, the cross member defining at least two deflectors that converge towards the aperture to deflect the fluid towards the aperture; the cross member supporting axially displaceable pins adapted to move
5 across the aperture to decrease or increase the cross-section of the aperture.

6 The snow making gun according to claim 5 wherein the ends of the pins are chamfered.

7 The snow making gun according to either claim 5 or 6
10 wherein electrically driven linear actuators control displacement of the pins.

8 A nozzle for producing a flat spray pattern, the nozzle comprising a fluid passageway terminating in a cross member having the outlet aperture, the cross member
15 defining at least two deflectors that converge towards the aperture to deflect the fluid towards the aperture; the cross member supporting axially displaceable pins adapted to move across the aperture to decrease or increase the cross-section of the aperture, wherein the outlet aperture
20 is an elongate slit with walls diverging slightly outwardly from the centre of the aperture.

9 The nozzle according to claim 8 wherein the ends of the pins are chamfered.

10 The nozzle according to either claim 8 or 9 wherein
25 electrically driven linear actuators control displacement of the pins.

- 12 -

11 A nucleator for snow making comprising a mixing chamber adapted to be fed by a source of water and compressed air, a converging-diverging nozzle having an inlet and an outlet, the mixing chamber being arranged to
5 feed an air/water mixture to the inlet of the nozzle.

12 The nucleator according to claim 11 wherein an adjustable valve controls flow of water to the mixing chamber.

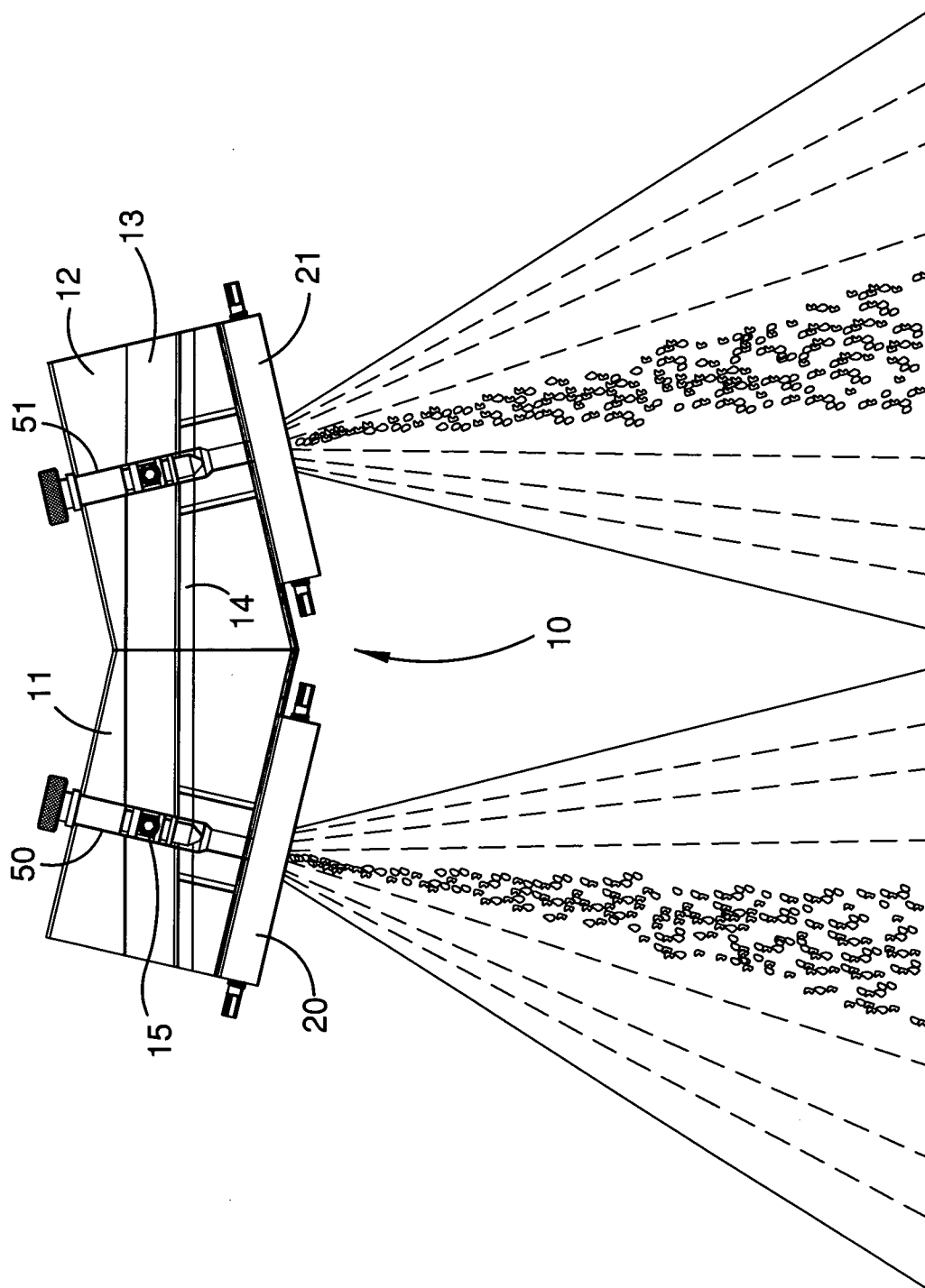


FIG. 1

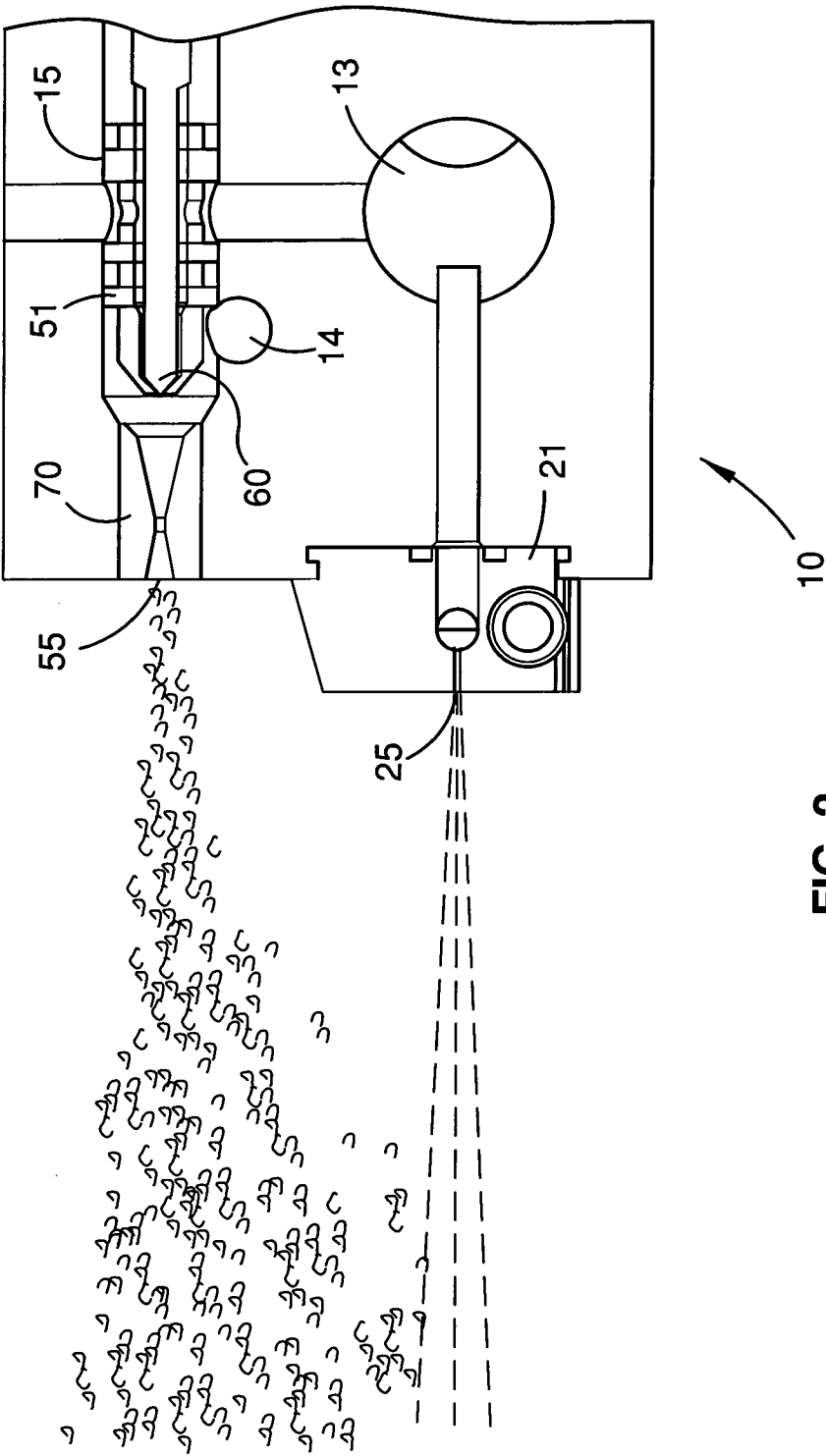


FIG. 2

3/7

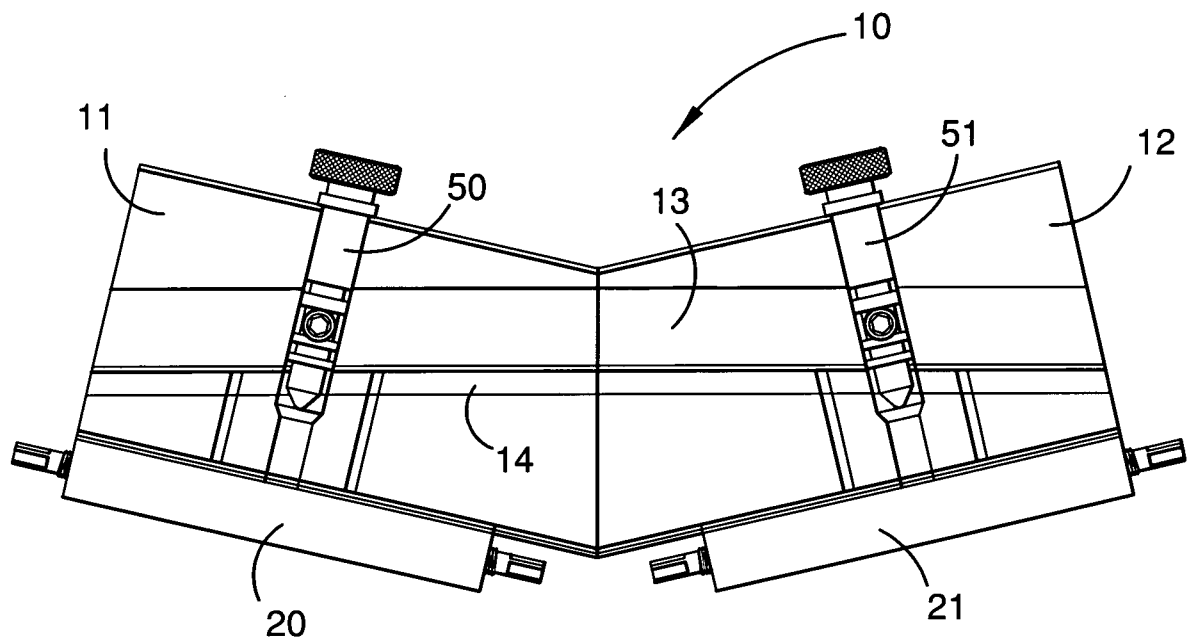


FIG. 3

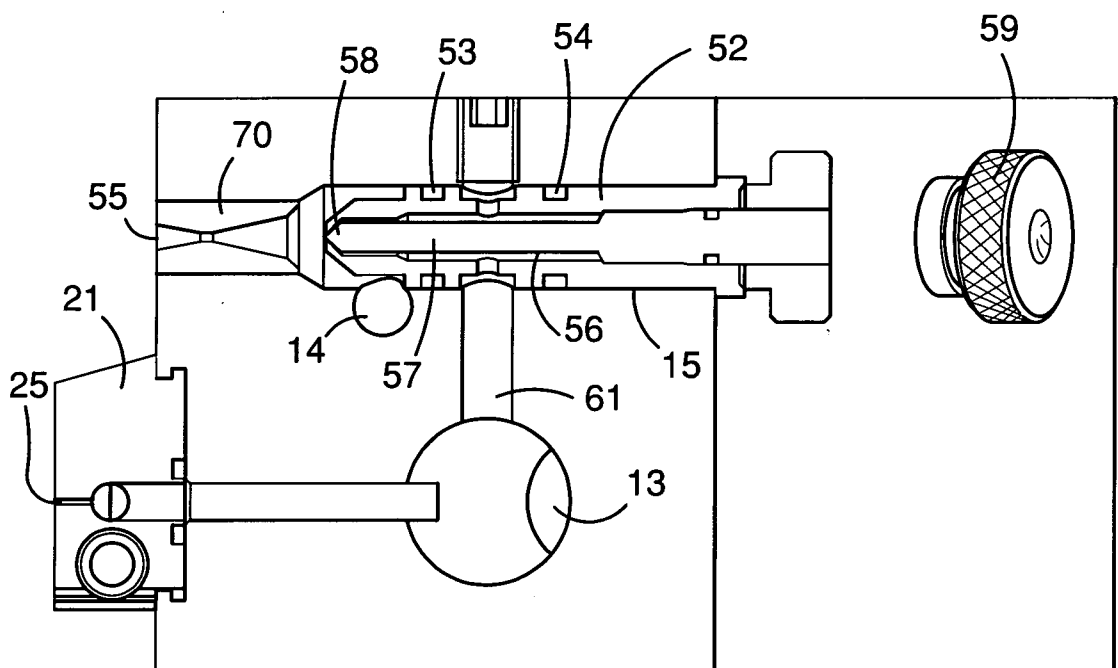


FIG. 4

4/7

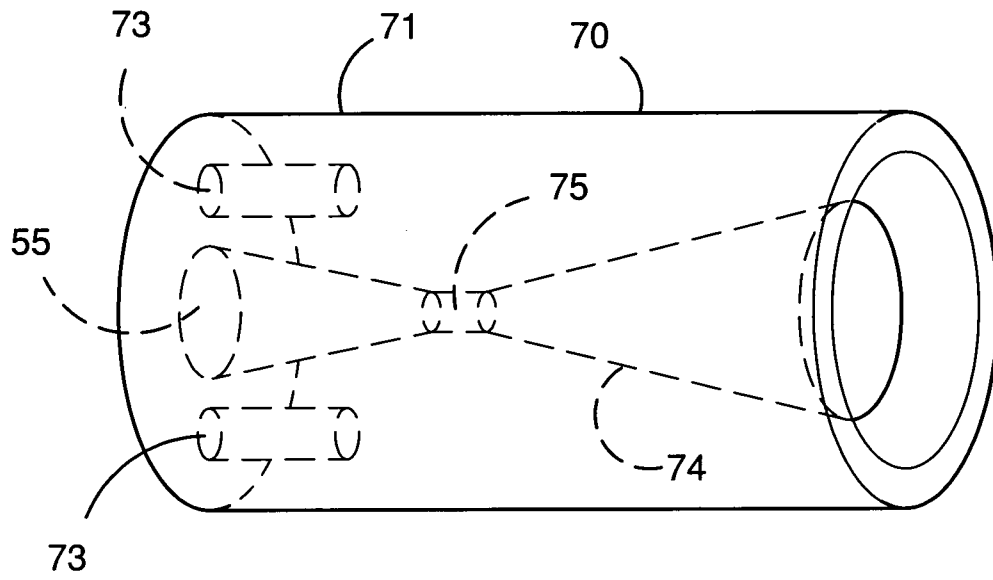


FIG. 5

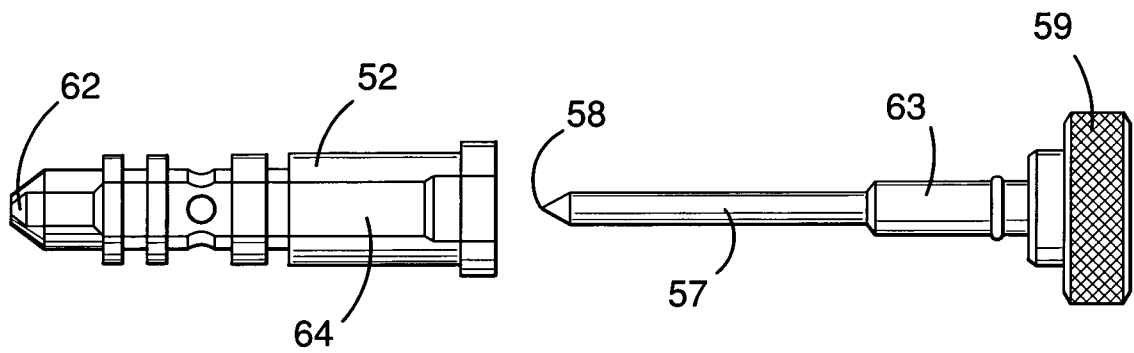


FIG. 6

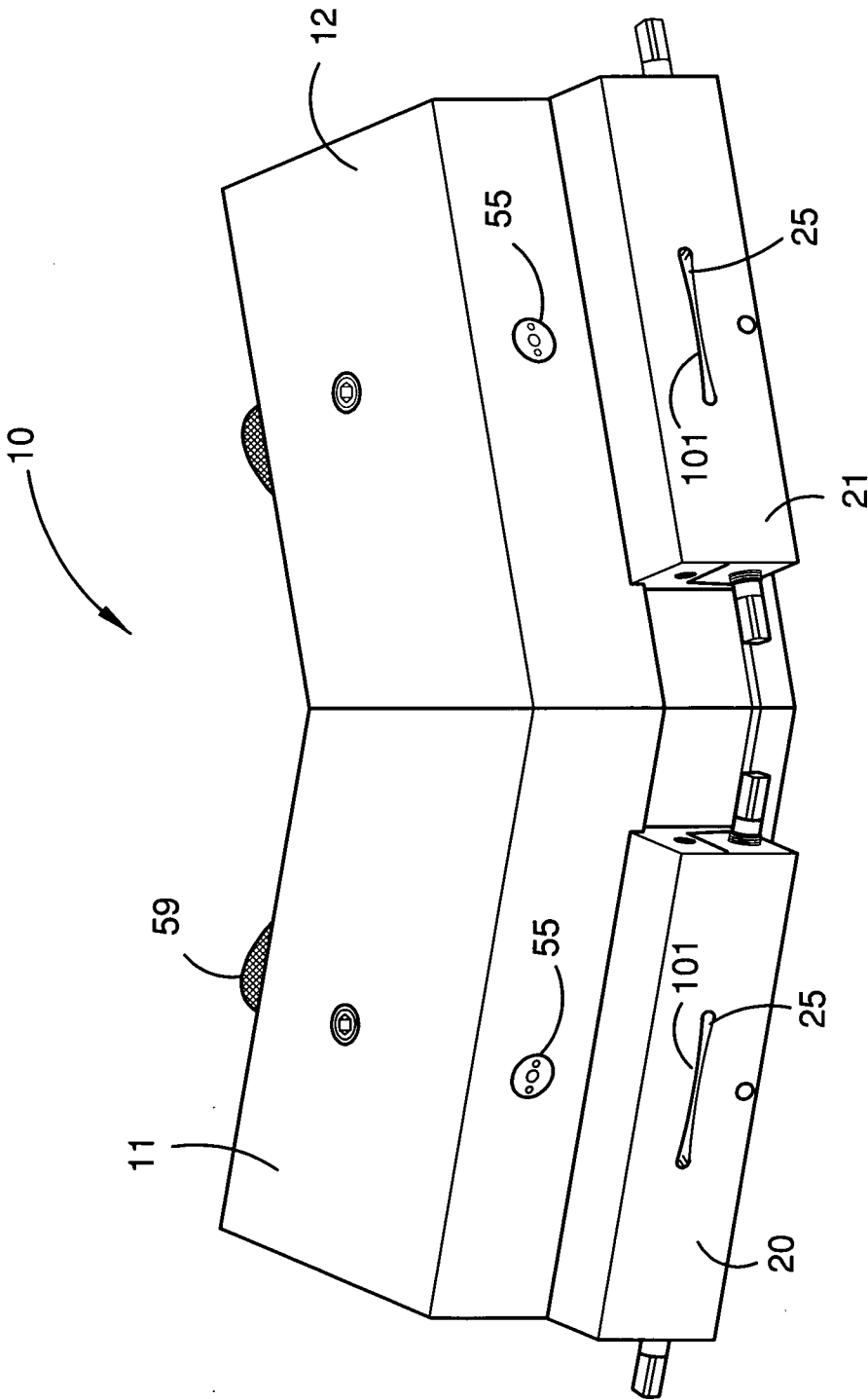


FIG. 7

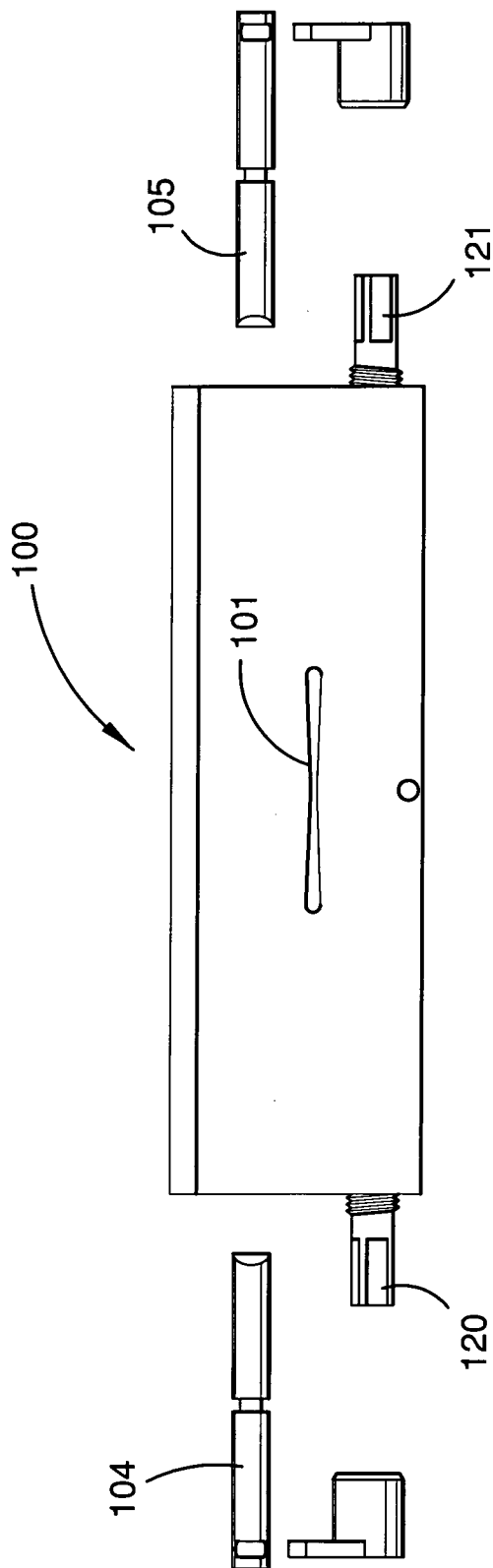


FIG. 8

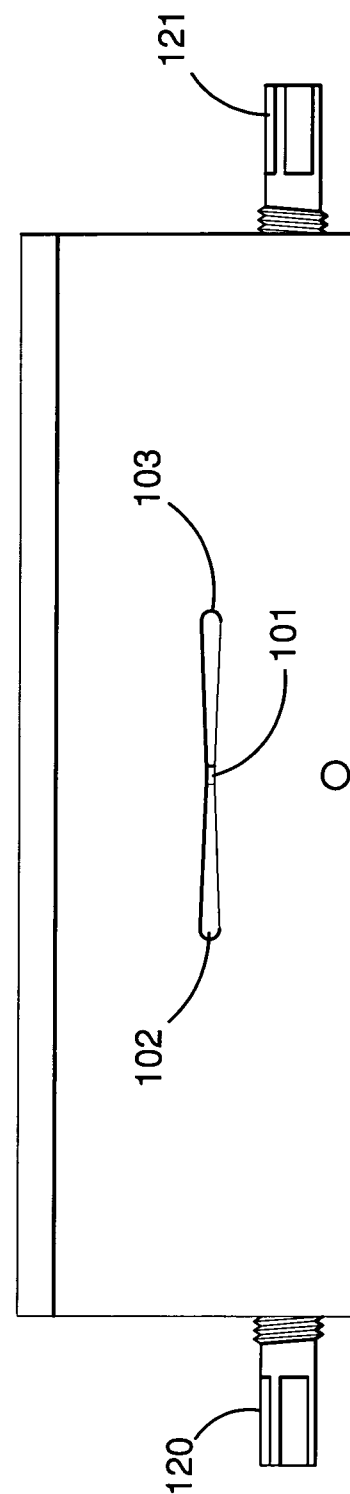


FIG. 9

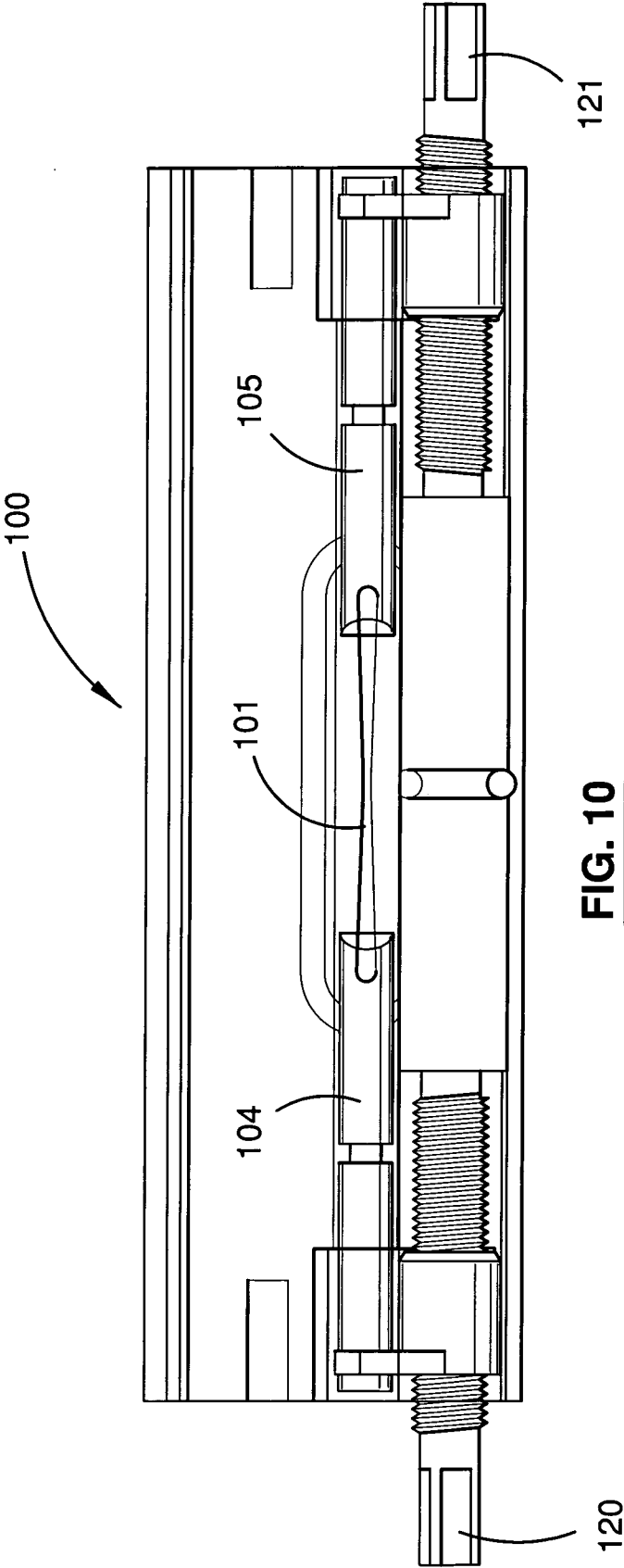


FIG. 10

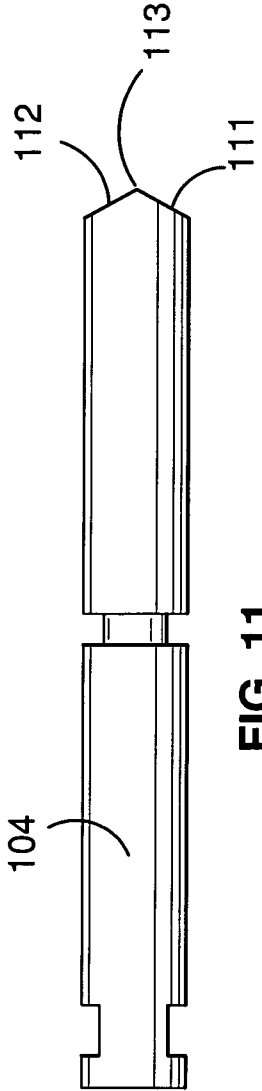


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2008/001452

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. *F25C 3/04* (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI:- F25C 3/ic and Keywords (mix+, snow, ice, nozzle, compressed air, nucleator)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3923247 A (WHITE) 2 December 1975 See in particular figure 1.	11
X	US 4915302 A (KRAUS, et al.) 10 April 1990 See in particular figure 1 and column 2 lines 19-43.	11
X	US 5090619 A (BARTHOLD, et al.) 25 February 1992 See figure 1 and column 2 lines 39-50	11, 12

☒ Further documents are listed in the continuation of Box C☒ See patent family annex

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
18 November 2008

Date of mailing of the international search report

24 DEC 2008

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
E-mail address: pct@ipaaustralia.gov.au
Facsimile No. +61 2 6283 7999

Authorized officer

A Davies
AUSTRALIAN PATENT OFFICE
(ISO 9001 Quality Certified Service)
Telephone No : +61 2 6283 2072

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2008/001452

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, 5699961, A (RATNIK, et al.) 23 December 1997 See whole document.	1 to 7, 11,12
A	WO, 2004/087329 A1 (DODSON) 14 October 2004 See whole document.	1 to 7, 11,12

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Supplemental Box

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-7, 11,12

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Supplemental Box

(To be used when the space in any of Boxes I to IV is not sufficient)

Continuation of Box No: III

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the international searching authority has found that there are two inventions:-

1. Claims 1 to 7, 11 and 12 are directed to the field of snow making and snow making guns having nucleators in which water and compressed air are fed to a nucleator chamber having an outlet aperture. It is considered that the nucleator in which water and compressed air are fed to a nucleator chamber having an outlet aperture comprises a first "special technical feature".

2. Claims 8 to 10 are directed to the field of nozzles in which the nozzle comprises a fluid passageway terminating in a cross member with an outlet aperture and having at least two deflectors that converge toward the aperture in which the aperture is an adjustable elongated slit that has diverging walls. It is considered that the nozzle comprises a fluid passageway terminating in a cross member with an outlet aperture and having at least two deflectors that converge toward the aperture in which the aperture is an adjustable elongated slit that has diverging walls comprises a second "special technical feature".

Since the abovementioned groups of claims do not share either of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2 does not exist.

Accordingly the international application does not relate to one invention or to a single inventive concept.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2008/001452

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
US	3923247	CA	1000066
		FR	2278407
US	4915302	NONE	
US	5090619	WO	9204585
US	5699961	EP	0824658
		WO	9635087
WO	2004087329	AU	2004226877
		BR	PI0409231
		CA	2515905
		CN	1761527
		EP	1613435
		KR	20060015495
		MX	PA05010301
		NZ	542154
		US	2006113400
		ZA	200506417
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.			
END OF ANNEX			