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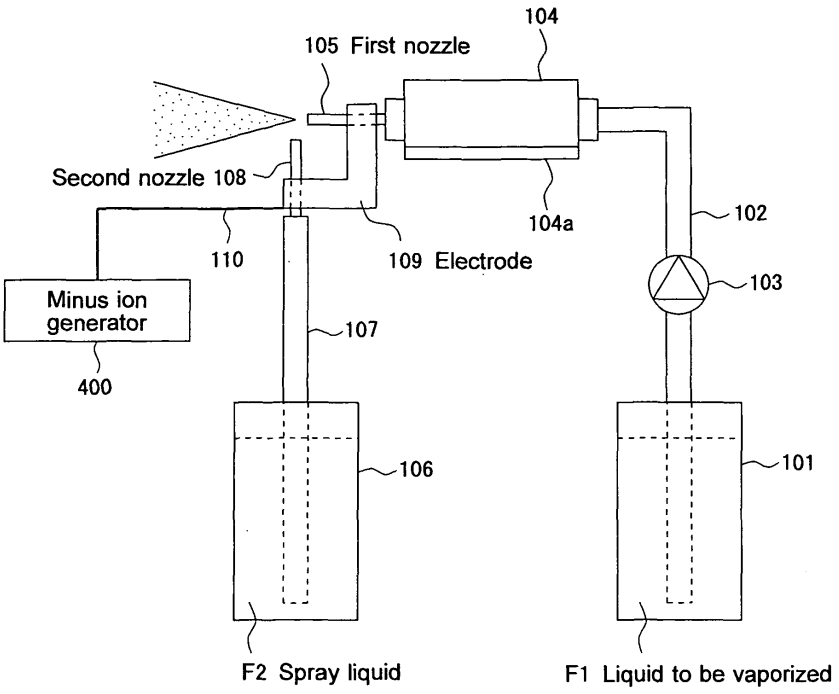
(54) Liquid spraying device

(57) A liquid spraying device provided with a first nozzle (105) for jetting out air or vapor at high speed and a second nozzle (108) for discharging a liquid chemical (F2), formed into particulates by a negative pressure created by the air or vapor jetted out of the first nozzle (105), further provided with an electrode (109) for short-circuiting the first nozzle (105) and the second nozzle (108) and a minus ion generator (400) for applying a DC high voltage to the electrode (109).

Fig. 3



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Description

[0001] The present invention relates to a liquid spraying device which atomizes a liquid chemical for deodorization, sterilization, air purification, antimicrobial treatment, smear resistance or similar purposes and discharges it into the air.

[0002] Known liquid spraying devices of this kind include what is disclosed in Japanese Patent Publication 2002-216933. This liquid spraying device comprises a liquid tank accommodating a liquid to be vaporized such as water, a liquid pipe conduit of which one end is inserted into the liquid tank, a pump intervening on the liquid pipe conduit, a vaporizer whose inlet is connected to the other end of the liquid pipe conduit, a first nozzle connected to the outlet of the vaporizer, a spray liquid tank accommodating a spray liquid (deodorizing liquid), a spray liquid pipe conduit of which one end is inserted into the spray liquid tank, a second nozzle connected to the other end of the spray liquid pipe conduit, and an electrode arranged ahead of the second nozzle. The vaporizer is provided with an electric heater and a porous element. The liquid to be vaporized fed into the porous element is heated by the electric heater and thereby vaporized, and the resultant vapor is jetted out from the outlet of the vaporizer.

[0003] This type of liquid spraying device is known as a two-fluid spraying device, which sprays a spray liquid (deodorizing liquid) in the following manner. When the liquid to be vaporized in the liquid tank is pumped into the heated porous element in the vaporizer, the liquid is vaporized by heating, and the resultant vapor is jetted out from the tip of the first nozzle. The spray liquid in the spray liquid tank, instantly as it is caused by this jet vapor to be sucked up by the tip of the second nozzle, collides with the jet vapor to be atomized and blown out forward.

[0004] Liquid chemicals that can be sprayed by using such a liquid spraying device not only include chemicals intended for sterilization or deodorization but also are joined in recent years by ones effective for air purification, antimicrobial treatment, thorough or substantial disinfection, smear resistance, defogging or similar purposes. These chemicals include photocatalyst solutions containing titanium dioxide. Since such photocatalyst solutions exert their effect with the catalytic action of light, they are required to stick well to the wall or glass surface.

[0005] Conventional liquid spraying devices electrically charge either positively or negatively the particulates discharged by applying a high voltage with an electrode to contact the particulates discharged into the air with odoriferous matter at high efficiency. However, the conventional liquid spraying devices do not provide sufficient sticking of the spray to the wall surface or the like, and accordingly are required to be improved in the sticking performance of the spray.

[0006] An object of the present invention is to provide a liquid spraying device enabling particulates in a liquid chemical such as a photocatalyst solution sprayed into space to stick well to the wall surface or the like.

[0007] In order to achieve this object, a liquid spraying device according to the invention comprises a first nozzle for jetting out air or vapor at high speed and a second nozzle for discharging a liquid chemical formed into particulates by a negative pressure created by the air or vapor jetted out of the first nozzle, the first nozzle and the second nozzle being formed of conducting members in at least the tips thereof, the liquid spraying device being further provided with an electrode for short-circuiting the conducting part of the first nozzle and the conducting part of the second nozzle and a DC high voltage generator for applying a DC high voltage to the electrode, wherein particulates discharged from the second nozzle are loaded with positive or negative electric charges by the application of the DC high voltage.

[0008] According to the invention, particulates of liquid chemical can be efficiently loaded with positive or negative electric charges by the application of the DC high voltage generated by the DC high voltage generator to the electrode short-circuiting the conducting part of the first nozzle and the conducting part of the second nozzle. This serves to improve the contact of the particulates of the liquid chemical with odoriferous matter and their sticking to the wall surface, glass surface or the like.

[0009] Or a liquid spraying device according to the invention comprises a first nozzle for jetting out air or vapor at high speed and a second nozzle for discharging a liquid chemical, formed into particulates by a negative pressure created by the air or vapor jetted out of the first nozzle, the first nozzle and the second nozzle being formed of conducting members in at least the tips thereof, the liquid spraying device being further provided with a DC high voltage generator for applying a DC high voltage to either the first nozzle or the second nozzle, wherein particulates discharged from the second nozzle are loaded with positive or negative electric charges by the application of the DC high voltage.

[0010] According to the invention, particulates of liquid chemical can be efficiently loaded with positive or negative electric charges by the application of the DC high voltage to either the first nozzle or the second nozzle. This serves to improve the contact of the particulates of the liquid chemical with odoriferous matter and their sticking to the wall surface, glass surface or the like.

[0011] Other objects, configurative features and advantages of the invention will become more apparent from the following detailed description.

Fig. 1 shows an external perspective view of a liquid spraying device;
Fig. 2 shows a profile of the liquid spraying device;
Fig. 3 shows the configuration of an essential part of the liquid spraying device; and
Fig. 4 is a circuit diagram of a minus ion generator.

[0012] A liquid spraying device, which is a preferred embodiment of the present invention, will be described

below with reference to the accompanying drawings. Fig. 1 shows an external perspective view of the liquid spraying device, and Fig. 2, a profile of the same.

[0013] A liquid spraying device 1 is provided with a main unit 100 and a base 200 with a rotating mechanism for rotating the main unit 100 in the horizontal direction as shown in Fig. 1. The main unit 100 is provided with a case whose front face slightly bulges forward. A spray outlet 111 is formed near the upper central part of the front face of the case, and a control unit 112 including a power switch is arranged toward one side of the front face of the case.

[0014] The base 200 is provided with a thin cylindrical case 210, of which the upper face is circular and the lower face is open, a bottom plate (not shown) and handles 211 fitted to the bottom plate and arranged on the right and left sides of the case 210. A rotation shaft (not shown) provided on the bottom plate is connected to the inside center of the case 210. Further, a motor (not shown) for rotating the case 210 is connected to the bottom plate. By driving this motor, the main unit 100 is rotated in the horizontal direction integrally together with the case 210. The rotating may either be unidirectional or reciprocating (in so-called swinging motions) within a range of a prescribed angle (e.g. about 300 degrees).

[0015] The main unit 100 is connected to the case 210 via a fitting member 300 with an elevation angle adjusting mechanism as shown in Fig. 2. The fitting member 300 is provided with a spindle 310 extending in the horizontal direction, a support 320 on which both ends of the spindle 310 pivot, and a supporting plate 330 whose end turnably pivots on the spindle 310 and which is fixed to the rear face of the main unit 100. This arrangement makes the elevation angle of the main unit 100 variable.

[0016] Next, the spraying mechanism of the main unit 100 of the liquid spraying device 1 will be described with reference to Fig. 3. Fig. 3 illustrates the configuration of the spraying mechanism of the liquid spraying device.

[0017] The main unit 100 of the liquid spraying device 1, as shown in Fig. 3, is provided with a liquid tank 101 accommodating a liquid to be vaporized F1, such as water; a liquid pipe conduit 102 of which one end is inserted into the liquid tank 101; a pump 103 intervening on the liquid pipe conduit 102; a vaporizer 104 whose inlet is connected to the other end of the liquid pipe conduit 102; a first nozzle 105 connected to the outlet of the vaporizer 104; a spray liquid tank 106 accommodating a spray liquid (liquid chemical) F2; a spray liquid pipe conduit 107 of which one end is inserted into the spray liquid tank 106; a second nozzle 108 connected to the other end of the spray liquid pipe conduit 107; an electrode 109 arranged from the first nozzle 105 to the second nozzle 108; an electric wire 110 connected to a part of the electrode 109 near the second nozzle 108, and a minus ion generator 400 connected to the electric wire 110. The vaporizer 104 is provided with an electric heater 104a and a porous element (not shown). The liquid F1 fed into the porous element is heated by the electric heater 104a thereby vaporized, and the resultant vapor is jetted out from the outlet of the vaporizer 104. The spray liquid (liquid chemical) F2 can be selected from photocatalyst solutions effective for air purification, antimicrobial treatment, thorough or substantial disinfection, smear resistance or defogging in addition to ones intended for sterilization or deodorization.

[0018] The main unit 100 of this liquid spraying device 1 is known as a two-fluid spraying device, which sprays the spray liquid (liquid chemical) F2 in the following manner. When the liquid F1 in the liquid tank 101 is fed by the action of the pump 103 into the heated porous element in the vaporizer 104 in a heated state, the liquid F1 is vaporized by heating, and the resultant vapor is jetted out from the tip of the first nozzle 105. The spray liquid F2 in the spray liquid tank 106, instantly as it is sucked up by the tip of the second nozzle 108, collides with the jet vapor and is thereby atomized and blown out forward.

[0019] At least the outer faces of the tips of the first nozzle 105 and the second nozzle 108 are conductive. Further, the first nozzle 105 and the second nozzle 108 are electrically short-circuited by the electrode 109. This configuration causes the particulates of the spray liquid F2 sprayed from the second nozzle are minus-ionized by a high DC voltage supplied from the minus ion generator 400.

[0020] A DC high voltage generator is used as the minus ion generator 400. As shown in Fig. 4, the minus ion generator 400 supplies the electrode 109 with a DC high voltage by converting a DC supplied from a power supply unit 401 into an AC with a switching circuit 410, an oscillator 420 and a switching transformer 430, and further rectifying it into a DC and raising its voltage with a Cockcroft-Walton voltage multiplier 440. The particulates of the spray liquid F2 sprayed from the second nozzle are thereby minus-ionized. Incidentally, since these constituent circuits are known ones, their description will be dispensed with here. It is preferable for the output voltage of the minus ion generator 400 to be 2000 V to 10000 V, and even more preferable to be 3000 V to 4000 V. In this embodiment of the invention, the output voltage is supposed to be 3600 V.

[0021] Since the sprayed particulates are minus-ionized by the minus ion generator 400 in this liquid spraying device 1, their sticking to the wall surface or the like is strengthened, and their deodorizing, sterilizing, air purifying and antimicrobial effects can be thereby enhanced. Moreover, as the whole main unit 100 is rotated in the horizontal direction and its elevation angle is adjustable, the liquid can be uniformly sprayed throughout the interior space of the room.

[0022] To add, the embodiment of the invention described above is only illustrative but not limitative. The scope of the invention is stated in the appended claims, and all modifications covered by the meaning of the claims are included in the invention.

[0023] For instance, although the electric wire 110 is connected to a part of the electrode 109 near the second

nozzle 108 in this embodiment, it may as well be connected near the first nozzle 105 or near the middle part between the first nozzle 105 and the second nozzle 108. When it is to be connected near the first nozzle, the minus-ionization of the vapor of the liquid F1 can minus-ionize the particles of the spray liquid F2 indirectly. Therefore, this alternative would be suitable where a spray liquid F2 to which a high DC voltage cannot be directly applied is to be used. Or when the electric wire 110 is to be connected near the middle part of the electrode, the electric charge of the particles of the spray liquid F2 can be regulated by adjusting the connecting position.

[0024] Further, though a DC high voltage is applied to both the first nozzle 105 and the second nozzle 108 in the foregoing embodiment by short-circuiting the first nozzle 105 and the second nozzle 108 with the electrode 109, the electric wire 110 may as well be applied to either the first nozzle 105 or the second nozzle 108 without providing the electrode 109. In this case, if the electric wire 110 is connected to the second nozzle 108, the sprayed particulates can be efficiently minus-ionized. On the other hand, if the electric wire 110 is connected to the first nozzle 105, the minus-ionization of the vapor of the liquid F1 can minus-ionize the particles of the spray liquid F2 indirectly. Therefore, this alternative would be suitable where a spray liquid F2 to which a high DC voltage cannot be directly applied is to be used.

[0025] Furthermore, though one main unit 100 is provided for one base 200 with a rotating mechanism, it is also conceivable to provide a plurality of main units 100 for a single base 200 with a rotating mechanism. Where two main units 100 are to be disposed, for instance, they can be arranged back to back on the base 200 so that each main unit 100 sprays the liquid in the reverse direction to the other.

[0026] In addition, the particles of the spray liquid F2 are minus-ionized in the foregoing embodiment, they may as well be plus-ionized.

Claims

1. A liquid spraying device (1) comprising a first nozzle (105) for jetting out air or vapor at high speed and a second nozzle (108) for discharging a liquid chemical (F2), formed into particulates by a negative pressure created by the air or vapor jetted out of the first nozzle (105),
   the first nozzle (105) and the second nozzle (108) being formed of conducting members in at least the tips thereof,
   the liquid spraying device (1) being further provided with an electrode (109) for short-circuiting the conducting part of the first nozzle (105) and the conducting part of the second nozzle (108) and a DC high voltage generator (400) for applying a DC high voltage to the electrode (109), wherein:

   particulates discharged from the second nozzle (108) are loaded with positive or negative electric charges by the application of the DC high voltage.

2. The liquid spraying device (1), as set forth in Claim 1, wherein:

   the position of applying said DC high voltage is near the second nozzle (108).

3. The liquid spraying device (1), as set forth in Claim 1, wherein:

   the position of applying said DC high voltage is near the first nozzle (105).

4. The liquid spraying device (1), as set forth in Claim 1, wherein:

   the position of applying said DC high voltage is near the middle point between the first nozzle (105) and the second nozzle (108).

5. A liquid spraying device (1) comprising a first nozzle (105) for jetting out air or vapor at high speed and a second nozzle (108) for discharging a liquid chemical (F2), formed into particulates by a negative pressure created by the air or vapor jetted out of the first nozzle (105),
   the first nozzle (105) and the second nozzle (108) being formed of conducting members in at least the tips thereof,
   the liquid spraying device (1) being further provided with a DC high voltage generator (400) for applying a DC high voltage to either the first nozzle (105) or the second nozzle (108), wherein:

   particulates discharged from the second nozzle (108) are loaded with positive or negative electric charges by the application of the DC high voltage.

6. The liquid spraying device (1), as set forth in any of Claims 1 through 5, further provided with:

   a rotating device (200) for rotating horizontally the direction of spraying the liquid.

7. The liquid spraying device (1), as set forth in Claim 6, wherein:

   one rotating device (200) is provided with a plurality of spraying mechanisms (100).

8. The liquid spraying device (1), as set forth in any of Claims 1 through 7, further provided with:

an elevation angle adjusting mechanism (300) capable of vertically adjusting the direction of spraying the liquid.

Fig. 1

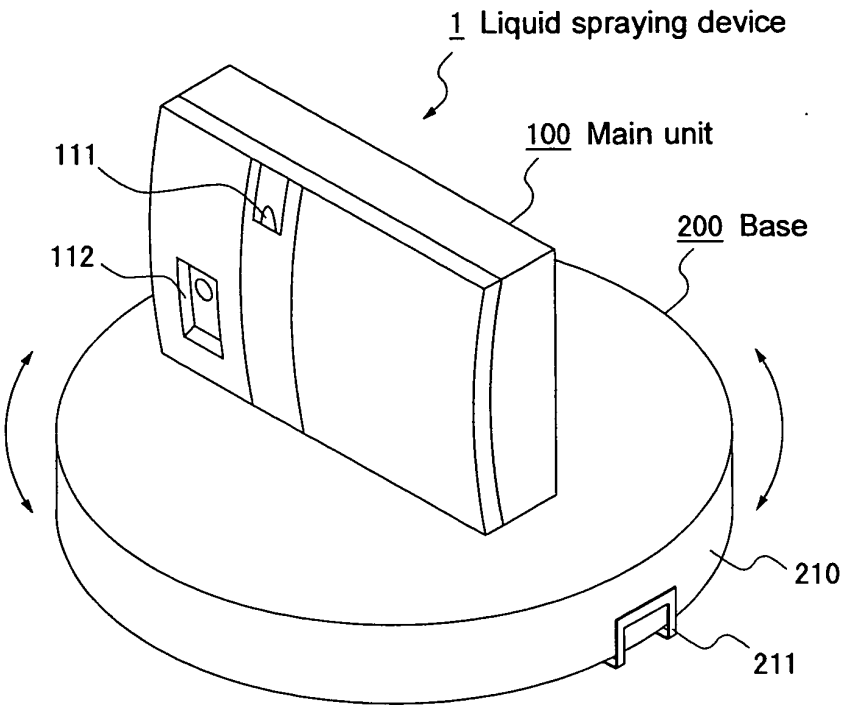

1 Liquid spraying device
100 Main unit
111
112
200 Base
210
211

Fig. 2

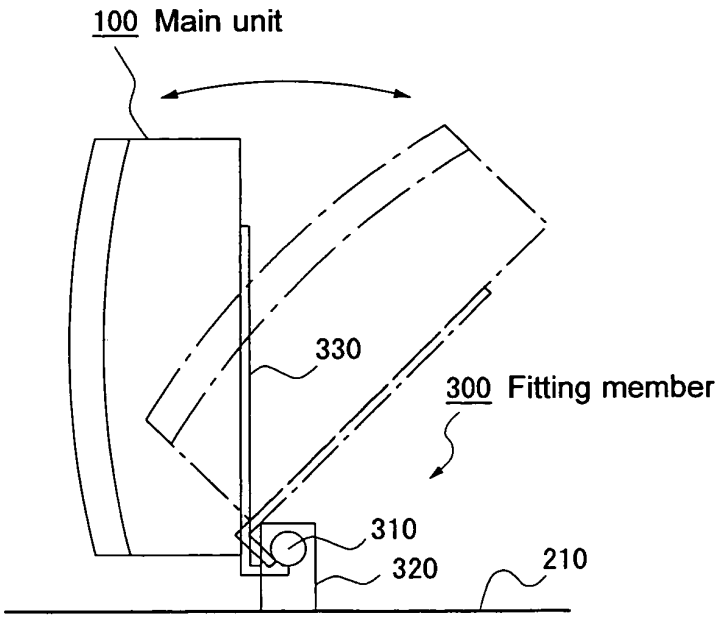

100 Main unit
330
300 Fitting member
310
320
210

Fig. 3

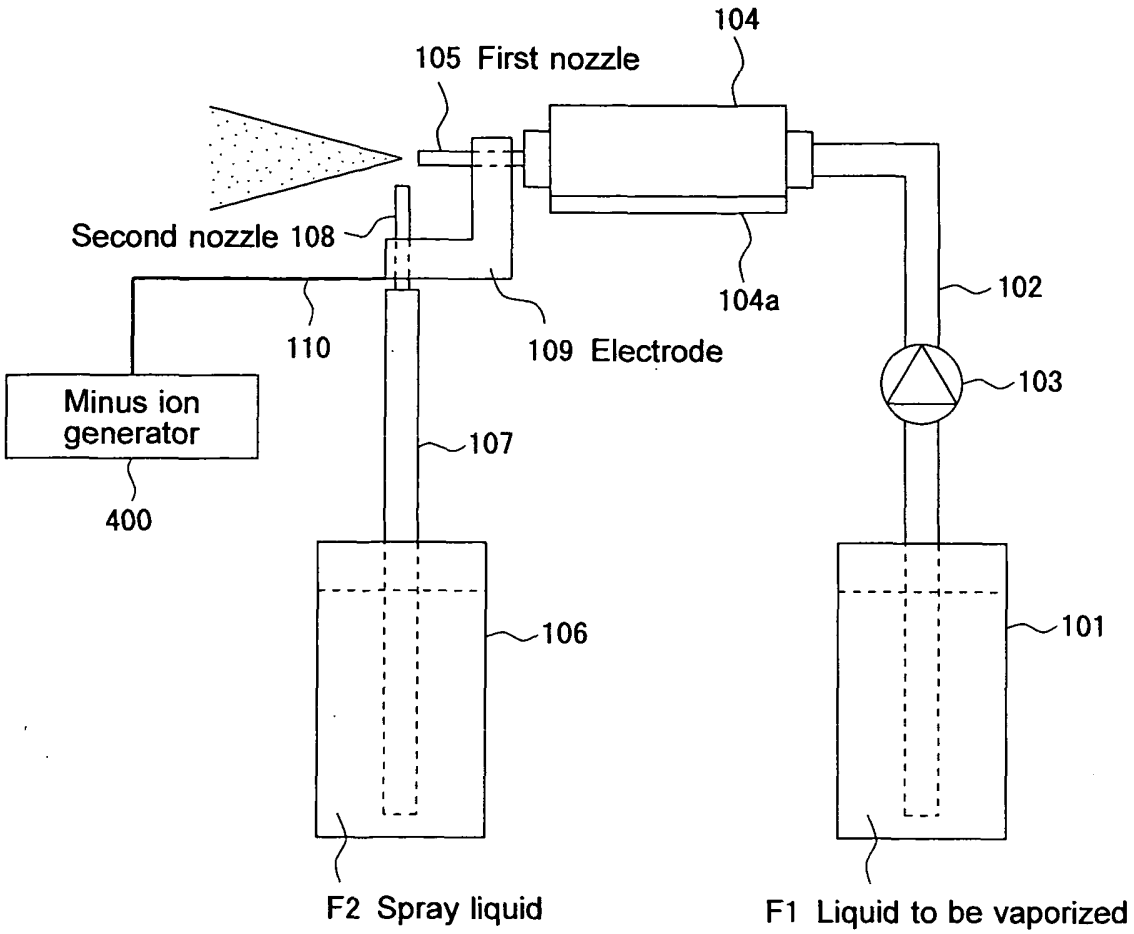
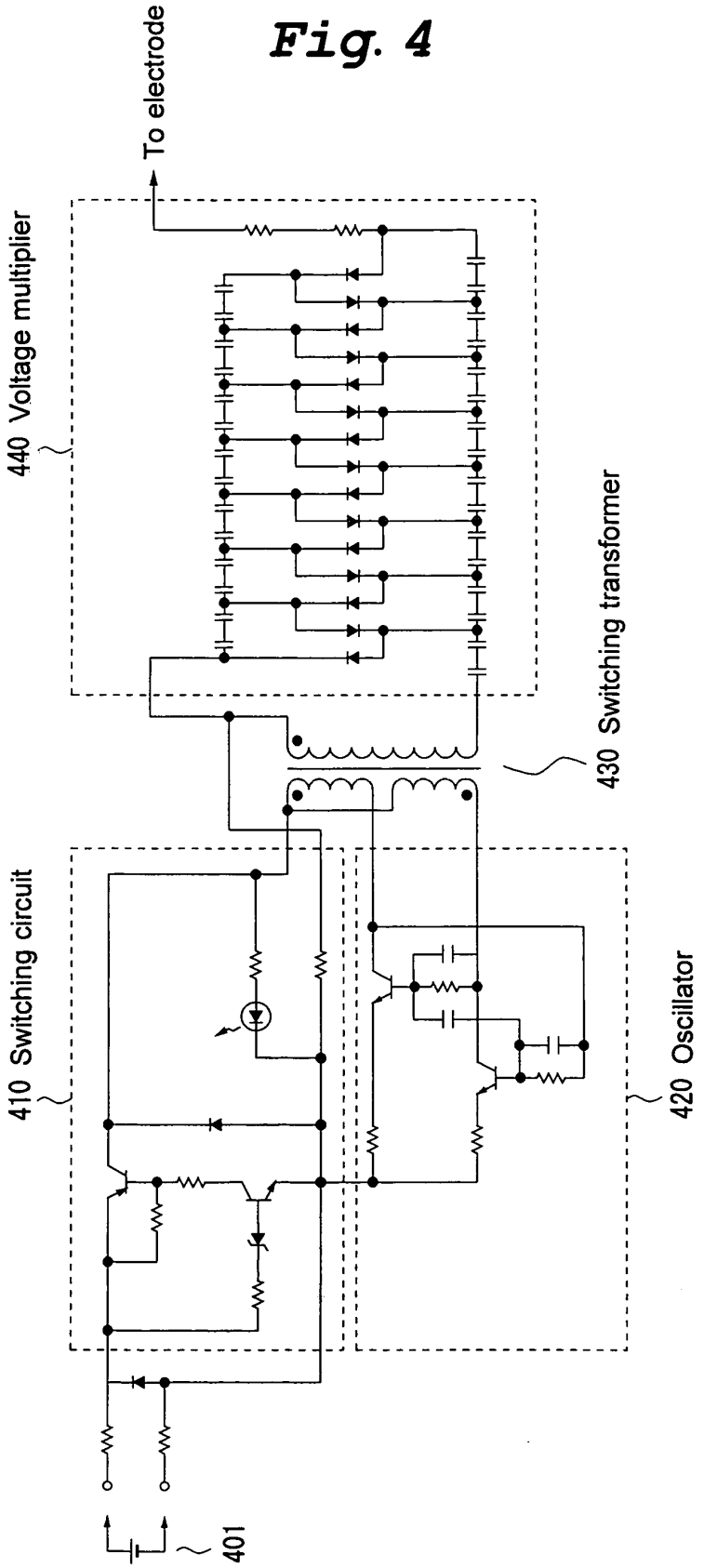

104
105 First nozzle
Second nozzle 108
104a
102
110
109 Electrode
103
Minus ion generator
107
400
106
101
F2 Spray liquid
F1 Liquid to be vaporized

Fig. 4


To electrode
440 Voltage multiplier
430 Switching transformer
410 Switching circuit
420 Oscillator
401

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EUROPEAN SEARCH REPORT

Application Number
EP 05 25 4812

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	CH 217 890 A (HYDRO-NITRO S. A) 15 November 1941 (1941-11-15)	1-5	B05B5/03
Y	* page 2, lines 36-76; figure 1 *	6-8	
Y	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 01, 30 January 1998 (1998-01-30) -& JP 09 225353 A (YUUKIYAN KK), 2 September 1997 (1997-09-02) * paragraphs [0013], [0020]; figures 1-3 *	6,8	
Y	FR 2 835 750 A (DUPLESSY HERVE) 15 August 2003 (2003-08-15) * figure 5 *	7	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7) B05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	28 October 2005	Flori, M

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

& : member of the same patent family, corresponding document

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28-10-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CH 217890 A	15-11-1941	NONE	
JP 09225353 A	02-09-1997	JP 3699770 B2	28-09-2005
FR 2835750 A	15-08-2003	AU 2003222897 A1	04-09-2003
		WO 03068279 A1	21-08-2003

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