



- (51) International Patent Classification:
B05D 1/30 (2006.01) *B05D 1/34* (2006.01)
B05B 1/26 (2006.01) *B05D 7/00* (2006.01)
- (21) International Application Number: PCT/FI2014/050668
- (22) International Filing Date: 2 September 2014 (02.09.2014)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 20135904 9 September 2013 (09.09.2013) FI
- (71) Applicant: **BENEQ OY** [FI/FI]; Olarinluoma 9, FI-02200 Espoo (FI).
- (72) Inventors: **ALITALO, Ville**; c/o Beneq Oy, Olarinluoma 9, FI-02200 Espoo (FI). **ASIKKALA, Kai**; c/o Beneq Oy, Olarinluoma 9, FI-02200 Espoo (FI). **TAMMELA, Simo**; c/o Beneq Oy, Olarinluoma 9, FI-02200 Espoo (FI). **VIR-TANEN, Sauli**; c/o Beneq Oy, Olarinluoma 9, FI-02200 Espoo (FI).

- (74) Agent: **KOLSTER OY AB**; Iso Roobertinkatu 23, P.O.Box 148, FI-00121 Helsinki (FI).
- (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, BN, BR, BW, BY, BZ, CA, CH, CL, 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, IR, IS, JP, KE, KG, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

[Continued on next page]

(54) Title: METHOD OF COATING A SUBSTRATE

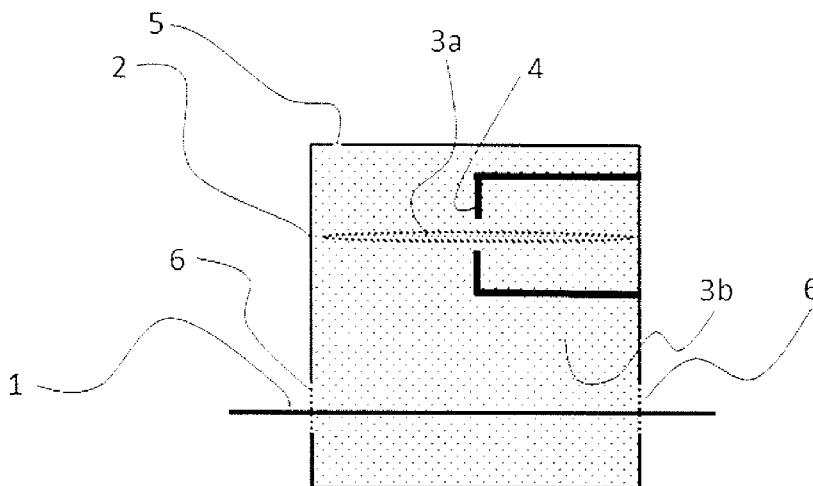


Fig. 2

(57) Abstract: The invention relates to a method of coating a substrate (1) in a deposition chamber (2). The method comprising the steps of providing a source of at least one liquid precursor; atomizing the at least one liquid precursor into liquid droplets in the deposition

[Continued on next page]



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, — *of inventorship (Rule 4.17(iv))*
GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted
a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

METHOD OF COATING A SUBSTRATE

FIELD OF THE INVENTION

The present invention relates to a method of coating a substrate, and more particularly to what is stated in the preamble of independent claim 1.

5 The present invention relates especially to coating substrates with aerosol produced in a deposition chamber.

BACKGROUND OF THE INVENTION

The invention relates to generating aerosol in which the term aerosol means a fine fog of liquid droplets.

10 In the prior art a typical coating of a substrate happens in a deposition chamber by directing an aerosol jet toward the substrate such that the droplets of the aerosol jet are directed to the surface of the substrate to be coated. This type of coating is achieved by arranging the atomizing head facing to the surface of the substrate to be coated so that the aerosol jet is
15 directed to a first impingement point on a surface of the substrate and then the aerosol travels on the surface of the substrate to a second point where the aerosol which has not participated in the coating process is removed.

A disadvantage associated with the above mentioned arrangement is that the coating is not uniform and may comprise a striped effect on the
20 surface of the substrate due to uneven distribution of the aerosol from the atomizer.

Another prior art solution is that two atomized aerosol jets are oriented in a manner making them collide into one another so that aerosol is produced and then the produced aerosol is moved toward the substrate to be
25 coated preferably by blowing to it. By orienting the aerosol jets substantially directly against each other, aerosol is produced, the mobility thereof being momentarily approximately non-existent, whereby said aerosol may be moved in the desired direction with a separate gas flow oriented substantially to the collision point of the aerosol jets.

30 One of the disadvantages associated with the above arrangement is that the coating may not be even everywhere on the surface of the substrate. In practice, it has unfortunately proven difficult to provide sufficiently uniform coatings and the coating thickness variation over the substrate is too high.

BRIEF DESCRIPTION OF THE INVENTION

An object of the present invention is to provide a method so as to alleviate the above disadvantages. The objects of the invention are achieved by a method which is characterized by what is stated in the independent claim

5 1. The preferred embodiments of the invention are disclosed in the dependent claims.

The invention is based on the idea of atomizing at least one liquid precursor into liquid droplets in a deposition chamber for producing aerosol and filling the deposition chamber with aerosol for forming saturated aerosol
10 comprising coating material in the deposition chamber and gravitational settling of the aerosol droplets towards a surface of the substrate for coating the substrate in the deposition chamber. In other words the saturated aerosol falls down in the deposition chamber by gravitation and a surface of a substrate is coated by the aerosol droplets in the deposition chamber, the aerosol droplets
15 comprising coating material from the precursor.

The invention is based on the idea of creating saturated aerosol in an atmospheric state in the deposition chamber and forming a thin film on the surface of the substrate for coating the substrate. The saturated aerosol droplets settle by gravitation toward the substrate. The deposition chamber
20 stays by its whole volume in a saturated state (when considered about the gas) such that the liquid film does not dry unmanageable but instead drying is achieved in a manageable way when the coated substrate is moved in a separate drying chamber. According to the invention coating the substrate is arranged by settling the liquid droplets of the saturated aerosol to the surface
25 of the substrate for forming a thin film on the surface of the substrate by the droplets.

According to one embodiment of the invention at least one atomizer is arranged in the upper part of the deposition chamber for atomizing the at least one liquid precursor into liquid droplets.

30 In this application coating material or material means the precursor, i.e. the material that is atomized into aerosol.

The gravitation causes that the saturated aerosol becomes less dense when falling down in the deposition chamber and when touching the surface of the substrate the bigger droplets from the saturated aerosol fall
35 down on the surface of the substrate to coat the substrate and the rest of the aerosol comprising smaller droplets moves upward in the deposition chamber

so that in one embodiment of the invention excess aerosol is exhausted from the deposition chamber in the upper part of the deposition chamber for the re-use of the coating material. In other words, the gravitation causes that different sized droplets move in different velocity and this causes collisions
5 between droplets which in turn causes that bigger droplets are generated. This means that gravitational settling develops and more collisions are caused. All this eventually means that on the upper side of the atomizer concentration of the aerosol is reduced and the density becomes less and when excess aerosol is removed from the upper part of the deposition chamber this excess aerosol
10 comprises only a little part of the original material. This material can be separated from the removed aerosol and be reused again. Material means the coating material of the substrate, i.e. the precursors. In a state where the deposition chamber is full of aerosol the same amount of aerosol that is fed to the deposition chamber has to be removed therefrom, otherwise the aerosol
15 would penetrate in every opening of the deposition chamber. In other words, the method comprises a step of removing or recycling a remaining part of the saturated aerosol from the deposition chamber after the coating of the substrate. The method may comprise a step of collecting deposited precursor from the bottom of the deposition chamber for removing or recycling the
20 precursor. The method may also comprise a step of collecting deposited precursor from the walls of the deposition chamber for removing or recycling the precursor. The method may further comprise a step of removing an excess aerosol from the deposition chamber through an opening and separating precursor from the excess aerosol for removing or recycling the precursor.

25 The aerosol is denser when coming out from the atomizers than after the larger droplets of the aerosol have coated the substrate. This causes a whirl inside the deposition chamber because of the continuous production of aerosol and coating of the substrate, i.e. because of the difference between the densities in different parts of the deposition chamber. So near the surface
30 of the substrate the aerosol moves slowly from the settling point toward the rising point and in turn near the atomizers the movement is opposite. The aerosol whirl inside the deposition chamber, i.e. a big whirl in the whole deposition chamber, moves about 0.1 m/s while the exit speed of the aerosol in the atomizer is about 300 m/s. The movement and the generation of the
35 whirls can be affected by the form of the deposition chamber and the place where the atomizers are arranged. So a vertical movement is created in the

deposition chamber the direction depending on the geometry of the deposition chamber. These slow aerosol whirls can be further used in levelling the coating of the surface of the substrate when the substrate moves through the deposition chamber in the bottom part of the chamber so that the film will
5 become uniform transversely to the movement direction of the substrate. In one embodiment of the invention the position of the atomizer produces a slow whirl of the aerosol in the deposition chamber which together with the moving substrate will decrease the differences in the density of the aerosol and its effect to the evenness of the coating. In another embodiment of the invention
10 the form of the deposition chamber produces a slow whirl of the aerosol in the deposition chamber which together with the moving substrate will decrease the differences in the density of the aerosol and its effect to the evenness of the coating. In yet another embodiment of the invention height of the deposition chamber produces a high aerosol column in the deposition chamber in which
15 the differences of the aerosol produce equalizing effect in aerosol. In a preferred embodiment of the invention a horizontal or substantially horizontal movement is produced in the aerosol by a quick aerosol flow which produces turbulence in the aerosol in the deposition chamber in the level of the atomizers which produces an aerosol having a uniform density. This horizontal
20 or substantially horizontal movement in the aerosol is preferably produced by an atomizer producing the aerosol but it may be produced by a gas flow as well. In general the an aerosol produced in an atomizer atomizing the at least one liquid precursor into liquid droplets in the deposition chamber for producing aerosol generates besides the aerosol flow also slow movement in the aerosol
25 which whirls and affects in a levelling way to the coating of the substrate.

Part of the aerosol is deposited on the walls and on the ceiling of the deposition chamber and mostly on the bottom of the deposition chamber on those parts where there is no substrate. The structure of the deposition chamber is therefore designed so that all the liquid is flown to the bottom of the
30 deposition chamber and removed from the bottom through an aperture so that it can be reused. Because the whole deposition chamber is in a saturated state when considering the gas there is no drying and all the collected material has not dried in any phase. This makes it possible that the material can be reused. Because the saturated aerosol is moved by gravitation the substrate to be
35 coated is arranged in the bottom part of the deposition chamber. In a preferred embodiment of the invention the aerosol and the substrate are in a same

temperature. The substrate may be moved in the deposition chamber such that the substrate is arranged to go through the saturated aerosol or the substrate may be stationary or almost stationary during the coating.

Although the droplets in the aerosol have a difference in the size the
5 difference may not be great. In the method according to the invention the size of the liquid droplets is less than 25 μm . In a preferred embodiment of the invention the size of the liquid droplets is less than 10 μm and in a further embodiment of the invention the size of the liquid droplets is 1 - 5 μm . In an embodiment according to the invention the saturated aerosol comprises
10 coating material 0.5% - 4% by volume.

The saturated aerosol spreads in the deposition chamber uniformly filling the deposition chamber. The saturated aerosol has saturation vapour pressure which is defined by the publication *Aerosol Technology* by *William C. Hinds (A Wiley-Interscience Publication)* in the following: "The saturation
15 vapour pressure, also called the vapour pressure, is the pressure required to maintain a vapour in mass equilibrium with the condensed vapour (liquid or solid) at a specific temperature. When the partial pressure of a vapour equals its saturation vapour pressure, evaporation from the surface of a liquid just equals condensation on that surface and there is mass equilibrium at the
20 surface. The pressure in any sealed container that contains only a liquid and its vapour is the saturation vapour pressure of that material at the temperature of the container. A sealed container that contains air and liquid water in equilibrium will have a partial pressure of water vapour equal to the saturation vapour pressure of water at the temperature of the container."

25 The method comprises the steps of providing a source of at least one liquid precursor, atomizing the at least one liquid precursor into liquid droplets for producing aerosol in the deposition chamber, filling the deposition chamber with aerosol for forming saturated aerosol in the deposition chamber, and settling saturated aerosol by gravitation towards a surface of the substrate
30 for coating the substrate in the deposition chamber.

The saturated aerosol may be produced in different ways because liquid can be atomized into small droplets by a plurality of different techniques, such as with a gas-dispersing atomizer, a pressure-dispersing atomizer and an ultrasound atomizer. The saturated aerosol can be produced for example by
35 arranging two atomizing heads toward each other such that the aerosol jets discharged from the atomizing heads collide with each other in a collision point

such that a planar aerosol plane is created preferably in a substantially horizontal direction. When these kinds of aerosol planes are created continuously the deposition chamber fills and eventually saturated aerosol is produced. Another way of creating saturated aerosol is to arrange at least one
5 ultrasound source having an ultrasonic atomizer in the deposition chamber and converting at least one liquid precursor into aerosol such that saturated aerosol is produced in the deposition chamber.

The deposition chamber may be a closed deposition chamber so that it comprises a bottom wall, a top wall and side walls. Although being
10 closed the deposition chamber may have openings for the substrate to go through the deposition chamber but the openings preferably have some kind of a closure flap or other gating arrangement, for example in a form of a gas. In other words the deposition chamber comprises a closed upper part and openings for the substrate in the lower part of the deposition chamber. When
15 having an opening for the substrate in the deposition chamber the pressure between the deposition chamber and the outside world must be balanced so that there is no difference in pressure. One way is to control in exhaust flow and have it the same as the atomized aerosol flow. In another embodiment of the invention the deposition chamber may be at least partly open on the upper
20 part of the deposition chamber such that when the deposition chamber is full of aerosol the extra aerosol spreads out from the deposition chamber from the opening in the upper part or even a small opening in the ceiling of the deposition chamber is enough so that aerosol can escape through it. So the deposition chamber may be a cylinder like chamber having an open top or it
25 may have a roof like cover on top of it.

Relevant for the method according to the invention is that the atomizing process happens in the deposition chamber so that the aerosol is produced and is brought to the saturated state in the same chamber as the coating is applied on the surface of the substrate.

30 An advantage of the method of the invention is that the coating spreads on the surface of the substrate evenly and that the coating on the surface of the substrate is uniform. Another advantage of the method according to the invention is that the saturated aerosol has no specific direction but it is planar and radial at the same time so that it will spread out uniformly in
35 a large area.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following the invention will be described in greater detail by means of preferred embodiments with reference to the attached drawings, in which

Figure 1 shows one example of creating a planar aerosol plane in a deposition chamber; and

Figure 2 shows a different phase of the example shown in figure 1 in which the aerosol spreads in the deposition chamber.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a deposition chamber 2 having a substrate 1 in the bottom part of the deposition chamber 2 and an atomizer 4 arranged in the upper part of the deposition chamber 2. In this embodiment the deposition chamber 2 is a closed deposition chamber such that there are openings 6 only for the substrate 1 to enter and exit the deposition chamber 2 and an opening 5 for aerosol exit on the ceiling of the deposition chamber 2. The openings 6 are preferably controlled by for example a gas flow in the opening. The atomizer 4 can be different than what is shown in this figure and the method according to the invention is not limited to a specific way of creating saturated aerosol. In this example the at least one liquid precursor is atomized in two atomizing heads that are arranged in a vertical direction such that the heads are facing toward each other. The aerosol jets collide each other in a collision point in a midpoint from the opposing atomizing heads. The collision creates first a planar aerosol plane 3a which spreads radially and symmetrically in the deposition chamber 2. In this embodiment the atomizers are arranged in the middle of the deposition chamber so that the saturated aerosol will spread uniformly in the chamber but the atomizers can also be placed in another position which affects the spreading of the saturated aerosol and generate a large and slow aerosol whirl having the dimensions of the whole deposition chamber 2. Figure 1 shows a starting point for the process.

Figure 2 shows what takes place in the deposition chamber 2 when the deposition chamber 2 is filled with aerosol such that saturated aerosol is created. In the figure the two atomizers 4 continuously atomize liquid precursor into liquid droplets such that a planar aerosol plane 3a is produced. The produced aerosol plane 3a spreads in the deposition chamber 2 and unites with other aerosol planes 3a so that the deposition aerosol flux 3b is formed. When the deposition chamber 2 is full of aerosol it becomes also saturated.

The saturated aerosol falls down to the bottom part of the deposition chamber 2 where the substrate 1 is arranged and the droplets of the saturated aerosol are gravitationally settled on the surface of the substrate to form a thin film on the surface of the substrate 1. The atomizers 4 produce planar aerosol planes 3a continuously and the gravitation affects to the produced planar aerosol planes 3a which finally fill the deposition chamber 2 and become saturated. The saturated aerosol falls down in the deposition chamber 2 toward the substrate. This continuous aerosol output creates a bigger and bigger aerosol flux 3b that eventually becomes saturated. The aerosol falls towards the surface of the substrate 1 on the bottom of the deposition chamber 2. The substrate 1 may be stationary in the deposition chamber 2 or it may be moved through the deposition chamber 2 and through the saturated aerosol. The coating of the substrate 1 is arranged in the deposition chamber 2 in which the aerosol is in a saturated state and therefore the droplets do not dry up, i.e. evaporate.

It will be obvious to a person skilled in the art that, as the technology advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

CLAIMS

1. A method of coating a substrate (1) in a deposition chamber (2), **characterized** in that the method comprising the steps of:
- providing a source of at least one liquid precursor;
 - 5 - atomizing the at least one liquid precursor into liquid droplets in the deposition chamber (2) for producing aerosol;
 - filling the deposition chamber (2) with aerosol for forming saturated aerosol in the deposition chamber (2); and
 - settling saturated aerosol by gravitation towards a surface of the
 - 10 substrate (1) for coating the substrate (1) in the deposition chamber (2).
2. A method according to claim 1, **characterized** in that a size of the liquid droplets is less than 25 μm .
3. A method according to claim 1, **characterized** in that a size of the liquid droplets is less than 10 μm .
- 15 4. A method according to claim 1, **characterized** in that a size of the liquid droplets is 1 - 5 μm .
5. A method according to any preceding claim, **characterized** in that the deposition chamber (2) comprises a closed upper part and openings (6) for the substrate (1) in the lower part of the
- 20 deposition chamber (2).
6. A method according to any preceding claim, **characterized** in that the deposition chamber (2) is at least partly open on the upper side of the deposition chamber (2).
7. A method according to any preceding claim, **characterized** in that the method further comprising a step of:
- 25 - removing or recycling a remaining part of the saturated aerosol from the deposition chamber (2) after the coating of the substrate.
8. A method according to any preceding claim, **characterized** in that the method comprising a step of:
- 30 - collecting deposited precursor from the bottom of the deposition chamber (2) for removing or recycling the precursor.
9. A method according to any preceding claim, **characterized** in that the method comprising a step of:
- 35 - collecting deposited precursor from the walls of the deposition chamber (2) for removing or recycling the precursor.

10. A method according to any preceding claim, **characterized** in that the method comprising a step of:

5 - removing an excess aerosol from the deposition chamber (2) through an opening (5) and separating precursor from the excess aerosol for removing or recycling the precursor.

11. A method according to any preceding claim, **characterized** in that the method further comprising a step of:

- arranging the substrate (1) in the bottom part of the deposition chamber (2).

10 12. A method according to any preceding claims, **characterized** by a step of:

- arranging the substrate (1) to go through the saturated aerosol.

13. A method according to any of preceding claims, **characterized** by a step of:

15 - coating the substrate (1) by settling the liquid droplets of the saturated aerosol to the surface of the substrate (1) for forming a thin film on the surface of the substrate (1) by the droplets.

14. A method according to any preceding claim, **characterized** in that the method further comprising a step of:

20 - creating a planar aerosol plane (3a) in a substantially horizontal direction.

15. A method according to any preceding claim, **characterized** in that the method further comprising a step of:

25 - arranging at least one atomizer (4) in the upper part of the deposition chamber (2) for atomizing the at least one liquid precursor into liquid droplets.

16. A method according to any preceding claim, **characterized** in that the method further comprising a step of:

30 - arranging at least one atomizer (4) in the middle of the deposition chamber (2) for atomizing the at least one liquid precursor into liquid droplets.

17. A method according to any preceding claim, **characterized** in that the saturated aerosol comprises coating material 0.5% - 4% by volume.

1/2

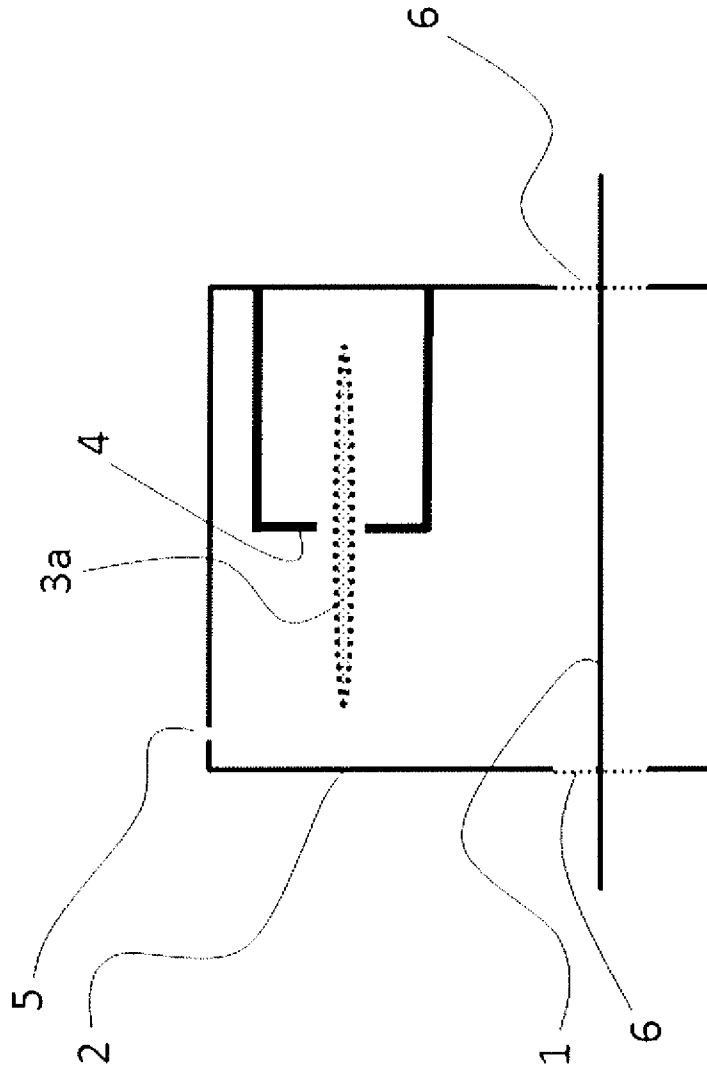


Fig. 1

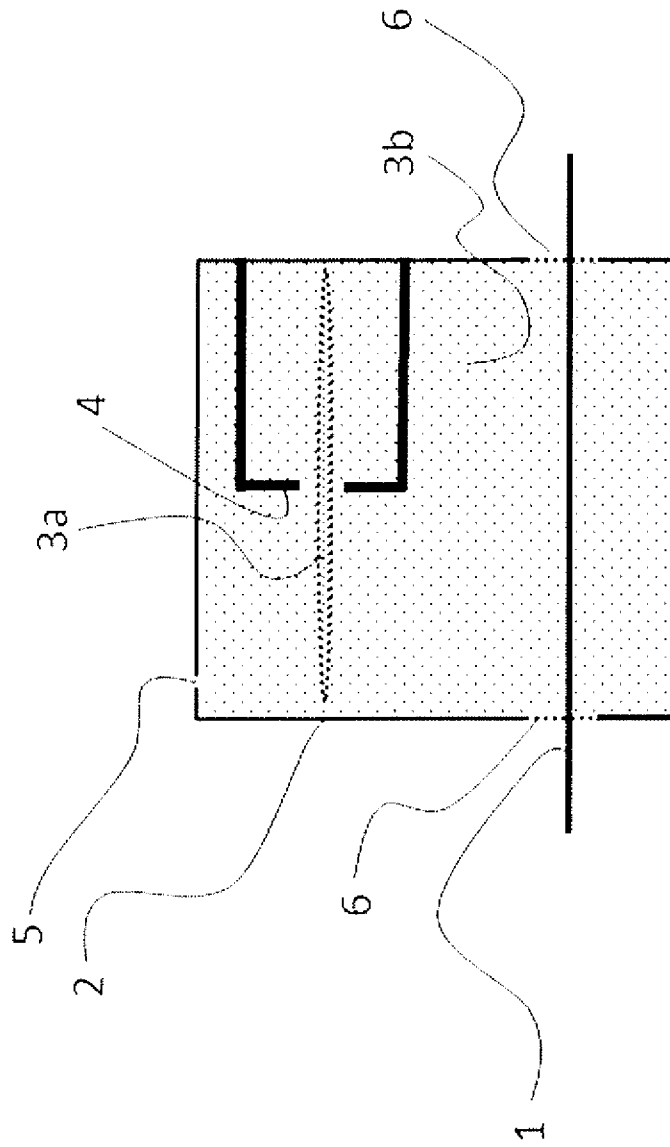


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2014/050668

A. CLASSIFICATION OF SUBJECT MATTER		
See extra sheet		
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)		
IPC: B05B, B05C, B05D, H01L		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
FI, SE, NO, DK		
Electronic data base consulted during the international search (name of data base, and, where practicable, search terms used)		
EPO-Internal, WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3647501 A (BUCKINGHAM ROBERT L et al.) 07 March 1972 (07.03.1972) chapter "description of the preferred embodiment" columns 1-4; fig. 1	1-17
A	JP S61249567 A (TOKYO COPAL KAGAKU KK) 06 November 1986 (06.11.1986) abstract, figs. 1-3	1-17
A	US 2009053397 A1 (BUCHNER CHRISTIAN [DE] et al.) 26 February 2009 (26.02.2009) paragraphs [0029]-[0039]; fig. 1	1-17
A	EP 0956909 A1 (COCKERILL RECH & DEV [BE]) 17 November 1999 (17.11.1999) whole document; figs. 1 and 2	1-17
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* "A"	Special categories of cited documents: 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	Date of mailing of the international search report	
19 December 2014 (19.12.2014)	22 December 2014 (22.12.2014)	
Name and mailing address of the ISA/FI Finnish Patent and Registration Office P.O. Box 1160, FI-00101 HELSINKI, Finland Facsimile No. +358 9 6939 5328	Authorized officer Timo Kallio Telephone No. +358 9 6939 500	

INTERNATIONAL SEARCH REPORT
Information on Patent Family Members

International application No.
PCT/FI2014/050668

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
US 3647501 A	07/03/1972	DE 2063196 A1	01/07/1971
		GB 1275016 A	24/05/1972
		JP S495449 B1	07/02/1974
		SE 366399 B	22/04/1974
.....			
JP S61249567 A	06/11/1986	JP S6312667 B2	22/03/1988
.....			
US 2009053397 A1	26/02/2009	US 8136478 B2	20/03/2012
		AT 481732 T	15/10/2010
		AU 2006237053 A1	26/10/2006
		AU 2006237053 B2	02/06/2011
		AU 2006237053 B8	07/07/2011
		PI 0608389	29/12/2009
		CA 2604256 A1	26/10/2006
		CN 101164139 A	16/04/2008
		CN 100594583 C	17/03/2010
		DE 102005019686 B3	13/04/2006
		DE 502006007888 D1	28/10/2010
		EP 1872386 A1	02/01/2008
		EP 1872386 B1	15/09/2010
		ES 2349656 T3	10/01/2011
		IL 186720 D0	09/02/2008
		JP 2008536669 A	11/09/2008
		JP 4955656 B2	20/06/2012
KR 20080009132 A	24/01/2008		
RU 2007137829 A	27/05/2009		
RU 2405227 C2	27/11/2010		
WO 2006111247 A1	26/10/2006		
.....			
EP 0956909 A1	17/11/1999	EP 0956909 B1	05/03/2003
		AT 233609 T	15/03/2003
		DE 69811858 D1	10/04/2003
		DE 69811858 T2	04/03/2004
		ES 2193506 T3	01/11/2003
.....			

CLASSIFICATION OF SUBJECT MATTER

IPC

B05D 1/30 (2006.01)

B05B 1/26 (2006.01)

B05D 1/34 (2006.01)

B05D 7/00 (2006.01)