(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 May 2018 (17.05.2018)

WIPO | PCT

(10) International Publication Number
WO 2018/087238 A1

(51) International Patent Classification:
G09F 19/12 (2006.01) *G09F 19/14* (2006.01)
G09F 19/18 (2006.01) *G09F 23/00* (2006.01)

(21) International Application Number:
PCT/EP2017/078782

(22) International Filing Date:
09 November 2017 (09.11.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
16198172.5 10 November 2016 (10.11.2016) EP

(71) Applicant: **ANHEUSER-BUSCH INBEV S.A.** [BE/BE]; Grand'Place 1, 1000 Brussels (BE).

(72) Inventor: **STEENACKERS, Marin**; Brouwerijplein 1, 3000 Leuven (BE).

(74) Agent: **BIIP CVBA**; Culliganlaan 1B, 1831 Diegem (BE).

(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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

WO 2018/087238 A1

(54) **Title:** A RECIPIENT FOR CONTAINING A BEVERAGE SUPPORTING A CAUSTIC IMAGE GENERATOR AND A METHOD FOR GENERATING A CAUSTIC IMAGE FROM A RECIPIENT FOR CONTAINING A BEVERAGE.

(57) **Abstract:** The present invention is directed to a recipient for containing a beverage comprising a printed caustic image generator on its outer surface. In addition, the present invention is directed to a method of generating a caustic image from a recipient for containing a beverage, comprising printing a refractive and/or reflective geometry on at least part of the recipient's outer surface, characterized in that the geometry is a caustic image generator. In particular the recipient for containing a beverage is a carbonated beverage container.

A RECIPIENT FOR CONTAINING A BEVERAGE SUPPORTING A CAUSTIC IMAGE GENERATOR AND A METHOD FOR GENERATING A CAUSTIC IMAGE FROM A RECIPIENT FOR CONTAINING A BEVERAGE.

FIELD OF THE INVENTION

The present invention relates to a recipient for containing a beverage supporting a caustic image generator, in particular a carbonated beverage glass container or metal can. In addition, the present invention relates to a method for generating a caustic image from a recipient for containing a beverage.

BACKGROUND OF THE INVENTION

In product marketing, eye-catching packaging design is of tremendous importance, as well as making logos, brandnames etc, a striking appearance. A recently developed technique in product packaging design is generating a caustic design by providing a caustic image generator into the packaging which enhances the attractiveness and visibility of the product.

Recently, recipients such as perfume or whiskey bottles were presented incorporating a caustic image generator. The combination of computer algorithms for designing a recipient in which a caustic image generator is integrated and high-precision molding delivers a perfume cap or whiskey bottle redirecting incident light thereby creating a brand logo or photograph on a receiver such as a table, a wall, a screen.

However, a main problem is that in packaging industry, and certainly in beverage container decoration, there is a clear trend moving towards flexibility and personalization. It is obvious that in such context using molding techniques for manufacturing beverage containers supporting a caustic image generator will not suffice.

Another problem is that molding techniques are limited to be used for plastics and glass, excluding for example metal or carton beverage containers supporting a caustic image generator.

A further problem related to molding techniques, is that, in order to obtain a glass container suitable for carbonated beverages having a strength, and minimum internal burst pressure, comparable to a blown glass container for carbonated beverage, one is obliged to use significantly higher amounts of glass to achieve higher wall thicknesses.

Besides molding, also 3D printing is proposed to produce recipients supporting a caustic image generator (http://web.media.mit.edu/~neri/MATTER.MEDIA/Theses/John_Klein_MIT_MSc_Thesis_Submission%20(1).pdf). However, the speed and manufacturing cost of 3D printing of articles, in particular beverage containers, is not comparable to the speed, manufacturing cost, and efficiency achieved with mass production facilities.

Considering the above, it is an object of the present invention to extend the range of material types that can be used for manufacturing recipients for containing a beverage being adapted to generate a caustic.

In particular it is an object to provide conventional recipients for containing a beverage being adapted for generating a caustic.

In addition, it is an object of the present invention to provide a method for obtaining recipients comprising a caustic image generator in comparatively inexpensive, quick and flexibly modifiable way, and moving its manufacturing process towards digitalization.

Further, it is an object of the present invention to provide a method enabling a caustic design to become usable design elements for carbonated beverage containers, in particular for blown carbonated beverage containers of conventional glass wall thickness, strength, and minimum internal burst pressure values.

Another object of the present invention is to provide a method enabling the manufacturing of metal recipients supporting a caustic image generator, in particular carbonated beverage cans, and carton recipients such as beverage bricks

SUMMARY OF THE INVENTION

The present invention is directed to a recipient for containing a beverage comprising a printed caustic image generator on its outer surface.

In addition, the present invention is directed to a method of generating a caustic image from a recipient for containing a beverage, comprising printing a refractive and/or reflective geometry on at least part of the recipient's outer surface, characterized in that the geometry is a caustic image generator..

In particular, the recipient for containing a beverage is a carbonated beverage container.

DETAILED DESCRIPTION OF THE INVENTION

Caustics are captivating light patterns created by materials focusing or diverting incident light by refraction or reflection. Caustics are known as random side effects, appearing, for example, at the bottom of a swimming pool, or generated by many glass objects, like drinking glasses or bottles. However, methods are known in the art to control caustic patterns to form a desired shape by optimizing the three-dimensional geometry of the reflective or refractive surface generating the caustic, in this whole text referred to as the caustic image generator.

In the context of the present invention, a recipient for containing a beverage may be any type of bottle, drinking glass, can, of any type of shape, material, or size. The beverage contained, or intended to be contained may be any type of beverage, and in particular carbonated beverages, such as sparkling water, soft drinks and beer.

A caustic, or caustic design, generated by a method or recipient of the present invention may comprise any type of picture, logo, text, graphic art, coding (QR-code, barcode) projected on a receiver such as a wall, a table, a screen, and the like.

In a first embodiment according to the present invention, a recipient for containing a beverage is provided comprising a printed caustic image generator on at least part of its outer surface. By providing on the recipient a caustic image generator which is printed, any type of recipient, preferably made from inexpensive material, such as glass, plastic, metal, paperboard, and produced at industrial scale, can be flexibly modified in a quick and efficient way, addressing the trend in beverage container decoration of moving towards flexibility and personalization.

A recipient for containing a beverage in accordance with the present invention may have a curved outer surface, i.e. at least the part supporting the caustic image generator may have a certain degree of curvature. Such curvature may be at least partially of a cylindrical, conical, or spherical form, or any form used in beverage drinking glasses or containers. Since the refractive and/or reflective behavior of a curved surface is different from the refractive and/or reflective behavior of a flat surface, the geometry of a printed caustic image generator on a curved outer surface may be adapted versus a printed caustic image generator on a flat outer surface in order to generate a comparable, or substantially the same caustic design.

In an embodiment of the present invention, a recipient for containing a beverage is providing wherein the printed caustic image generator generates a caustic predominantly by reflection or predominantly by refraction, or by a combination of both.

The caustic image generator may generate a caustic by refracting and/or reflecting the visible light spectrum. Also predominantly part of the visible spectrum may be used. In such case, for example the caustic image generator material or the recipients outer surface may absorb the part of the spectrum which is not refracted or reflected. In case of a visibly non-transparent recipient such as a metal beverage can, or a ceramic drinking cup, the caustic image generator may predominantly reflect the visible spectrum, whereas in case of visibly transparent recipients such as

drinking glasses and glass bottles, the caustic image generator may predominantly refract the visible spectrum.

In an embodiment of the present invention, the printed caustic image generator may comprise any type of material which is suitable for being three-dimensionally printed forming a refractive and/or reflective geometry onto a recipient for containing a beverage, i.e. any material which can be printed on such recipient by a suitable three-dimensionally digital printing technique. Examples thereof are three-dimensional printing techniques based on extrusion deposition, photopolymerization, or inkjet printing or laser ablation, laser sintering or other powder bed printing techniques, etc. Examples of materials may be thermoplastics, metallic alloys, photopolymers, resins, or compositions thereof, or inkjet inks.

Preferably, the caustic image generator is printed from inkjet ink. An advantage of an inkjet printed caustic image generator may be that it has initially a smoother surface after printing compared to other three-dimensional printing techniques, so that expensive and time-consuming steps of post processing as for example polishing can be avoided.

A caustic image generator printed on a recipient according to the present invention may comprise one or more layers of ink, preferably energy-cured ink such that the recipient can be exposed to heat treatment, such as pasteurization, without damaging the caustic image generator. Providing a heat resistant caustic image generator is in particular of importance for pasteurized beverage bottles and cans, and for hot-fill beverage containers.

In a further embodiment in accordance with the present invention, a recipient for containing a beverage may be provided wherein between the printed caustic image generator and the outer surface a printed image is present. Such printed image may comprise any type of picture, logo, text, legal text, graphic art, coding (QR-code, barcode). So the recipient may support a printed image of any type, and simultaneously generate an identical caustic design, or a caustic design of any other type.

The printed caustic image generator preferably comprises colorless transparent inks for obtaining optimal refraction, though translucent colored inks are also possible, the latter might generate a colored caustic design.

Not only the three-dimensional geometry of the caustic image generator, but also the reflective and refractive characteristics of the ink, or combination of inks, influences the caustic design generated.

Therefore, in embodiment of the present invention, the caustic image generator may comprise a combination of more reflective and more refractive inks.

In addition, also a mix of inks with different refractive indices may be present in the caustic image generator.

Alternatively, or in combination with foregoing embodiments, the caustic image generator may comprise a layer of more reflective material, e.g. a (partially) metallic ink or a foil, underneath a three-dimensional geometry of more transparent ink. Or, the caustic image generator may comprise a three-dimensional geometry of more transparent ink, with on top a at least partial layer of more reflective coating.

In general, a recipient, or at least the part of the outer surface supporting the caustic image generator, may be made of any type of material on which a caustic image generator can be printed, in particular inkjet printed, such as carton, glass, plastic, metal (in particular steel or aluminum), or a combination thereof.

In an embodiment of the present invention, a method is provided of generating a caustic image from a recipient for containing a beverage, comprising printing a caustic image generator on at least part of the recipient's outer surface.

By printing the caustic image generator onto the recipient, any type of recipient for containing a beverage, preferably made from inexpensive material, such as glass, plastic, metal, paperboard, and produced at industrial scale, can be flexibly modified in a quick and efficient way, addressing the trend in beverage container decoration of moving towards flexibility and personalization. In particular, conventionally used recipients for carbonated beverage can be easily modified for generating a caustic

image, without jeopardizing on critical characteristics such strength, minimum internal burst pressure values, oxygen diffusion, etc.
In particular, a glass container supporting a caustic image generator may be obtained having an internal burst pressure of at least 7 bar, or at least 8 bar, or at least 9 bar.

Any technique suitable for printing a three-dimensional geometric structure on a recipient for containing beverage may be used, such as for example three-dimensional printing techniques based on extrusion deposition, photopolymerization, or inkjet printing.

Depending on its topography, transparency, reflective and refractive properties, and whether the generation of a caustic image is intended in filled or empty condition, the caustic image generator's geometry and/or the material used to be printed may be adapted.

As already explained higher in this description, the outer surface on which the caustic image generator is to be printed may have a certain degree of curvature depending on the type of the recipient. Since the geometry of a caustic image generator on a curved surface differs from the geometry on a flat surface, not only the printing equipment requires to be suitable for printing on curved surfaces, but also the printing process and process parameters require to be suitable for printing three-dimensional caustic image generator structures that are more demanding as compared to caustic image generators computed to be printed on a flat surface.

In order to achieve necessary process speed and throughput as required in industrial processes, a cylindrical curvature may be preferred, because recipients with such cylindrical curvature, e.g. bottles, glasses, cans with a cylindrical body or at least cylindrical where the caustic image generator has to be printed, may be very suitable for being processed in rotational industrial printing tools, as mentioned further in his text.

In addition, as already shortly explained above, three-dimensional printing is a digital printing technique, i.e. customized manufacturing of recipients generating a caustic image may be obtained by simple selection of the desired caustic image and

corresponding printing parameters from a library of computed caustic image generators.

In a preferred embodiment in accordance with the present invention, printing the caustic image generator is done by inkjet printing.

A benefit of inkjet printing is that it allows printing of a relatively flat three-dimensional caustic image generator structure compared to printing a caustic image generator generating the same caustic with an alternative three-dimensional printing technique, so that expensive and time-consuming steps of post-polishing for enhancing the optical properties can be avoided.

Moreover, a smoother structure might be suffering less from abrasion upon manipulating the recipient, which is in particular of importance for beverage bottles and cans manipulated in filling lines.

Since in inkjet printing tiny droplets of ink are jetted onto the surface, it may be possible to smoothen edges and other geometric irregularities in the surface during actual printing by the placement of compensation droplets after curing a printed layer, as is described in US2015093544 (A1).

In a method in accordance with the present invention, a combination of more reflective and more refractive inks may be used by printing form a plurality of different ink sources, and/or by means of plurality of print heads.

Similarly, also a mix of inks with different refractive indices may be printed.

In alternative embodiment, a method in accordance with the present invention may comprise deposition of a reflective layer via printing or by adding a foil, or any other technique, before printing a three-dimensional geometry of transparent inks. Or, first a three-dimensional geometry of transparent inks may be printed which subsequently is then (at least partially) coated with a reflective layer.

In order to obtain a three-dimensional structure, the caustic image generator may be inkjet printed on the recipient layer by layer. Non curing solvent or water-based inkjet

inks may be used, however energy-curable ink is preferred, i.e. each layer of ink may be cured in any suitable manner, for example, radiation-cured by any suitable type of radiation like, for instance, ultraviolet, electron beam, or the like, or thermally-cured by convection oven, infrared lamps, or the like, or a combination of both radiation and thermal energy.

Inkjet printing techniques as used in the present invention may be piezoelectric inkjet printing, continuous type and thermal, electrostatic and acoustic drop on demand type.

In accordance with the present invention, three-dimensional inkjet printing processes may be used as for example described in WO2012093086 (A1), or WO2013167685.

In an embodiment of a method in accordance with the present invention, also industrial inkjet printing tools may be used for printing the caustic image generator as for example disclosed in WO2012022746 (A1) and WO201552240 describing a device for printing containers by means of inkjet printing on a rotating machine, a plurality of treatment stations having the print heads and optionally further devices which are required for the pre-treatment and post-treatment of the containers.

Another example is WO2015036334 describing a device for printing rotationally asymmetrical containers preferably by means of digital printing.

In an embodiment of a method according to the present invention, the caustic image generator to be printed may be computed from the desired caustic design to be generated, in other words one has to reconstruct the surface geometry of a real object given only an image of its caustic, so called inverse caustic design computing.

An example of a method for computing a caustic image generator is described in US2013301139 (A1) comprising: segmenting a target image into a plurality of image patches, each image patch corresponding to a lens patch in a two-dimensional array of lens patches on a refractive surface; then for each image patch, determining a plurality of regions in a source image which match a visual appearance of the image patch, and determining, for the corresponding lens patch, a mapping for each of the

plurality of determined regions that refracts light through the refractive surface towards a viewer's eye, assigning a match score to each of the plurality of mappings, and assigning one of the plurality of mappings to the image patch.

Another method of inverse caustic design computing is given in WO2016000926, herewith incorporated by reference, describing a methodology of designing a refractive surface, comprising providing a refractive object having a refractive surface with an initial geometry, determining a refraction of incident illumination through the refractive surface with the initial geometry to create a source irradiance distribution on a receiver; and determining a shape of the refractive surface of the refractive object such that a resulting irradiance distribution on the receiver matches a desired target irradiance.

In a particular embodiment of a method for generating a caustic design from a recipient containing a beverage, the caustic image generator is computed for generating a caustic from a filled container. In such case, optical properties not only of the recipient and the ink but also of the beverage to be contained has to be taken into account. For example, light incident on the caustic image generator may already be refracted and/or reflected to a certain extent depending on alcohol content, glucose content, etc…

The caustic image generator may further be designed for projecting a caustic image on a vertical plane such as a screen or a wall, or on a horizontal plane such as a table.

In a further embodiment of a method in accordance with the present invention, the method may further comprise a step of printing an image on the recipient, and the caustic image generator may be printed over the image in a common printing process step. Preferably, energy-curable inkjet printing is used for the reasons given earlier and for the reason that applying this embodiment via industrial inkjet printers may results in a high speed and highly efficient caustic image generator printing process on decorated recipients.

In particular in case of generating a caustic image from a carbonated beverage glass bottle supporting a cold-end-coating (CEC), a method in accordance with the present invention may comprise the step of removing the CEC before inkjet printing the caustic image generator. Adhesion as well as print quality of the caustic image generator may be improved compared to print quality on a glass substrate from which the CEC was not at least partially removed. Without being bound by any theory, the assumed reason for an improved print quality is that by removing at least part of the CEC layer to a level wherein the CEC is substantially completely removed, or wherein the remaining CEC layer has a thickness of less than 20 nm, the surface homogeneity is increased and results in a reduced tendency of the mobile and lower-viscous inkjet inks to move on the surface before solidification.

In a preferred embodiment, the CEC may be at least partially water soluble and can be at least partially removed by rinsing with tap water, technical water, purified water or distilled water. Depending on the rinsing time and temperature, the level of remaining CEC may then be varied or optimized from less than 20 nm to two or one monolayers, or to a level that only separated traces remain on the surface, or up to complete removal.

In another embodiment of the present invention, a primer layer may be provided between the recipient's outer surface and the caustic image generator to be inkjet printed in order to enhance adhesion of the ink, i.e. on a CEC or on a hot-end-coating (HEC), or on a pyrosil. Such primer may be preferably transparent and may comprise an adhesion promotor. Such primer may also be oxidized by flame, corona, or plasma treatment to enhance adhesion of the inkjet ink.

CLAIMS

1. A recipient for containing a beverage comprising a printed caustic image generator on its outer surface.

2. A recipient according to claim 1, wherein at least the part of the outer surface supporting the caustic image generator is cylindrical.

3. A recipient according to claim 1, wherein the printed caustic image generator comprises uv-cured inkjet inks.

4. A recipient according to claim 1, wherein the printed caustic image generator comprises transparent and/ or translucent ink.

5. A recipient according to claim 1, wherein between the printed caustic image generator and the outer surface of the recipient a printed image is present.

6. A recipient according to claim 1, wherein said part supporting the caustic image generator is made of refractive and/or reflective glass, refractive and/or reflective plastic, reflective metal, carton or a combination thereof.

7. A recipient according any of the above claims, being a carbonated beverage glass container, or a carbonated beverage metal can.

8. A recipient according any of the above claims, being a carbonated beverage glass container with a minimum internal burst pressure of at least 7 bar.

9. A recipient according any of the above claims, being a carbonated beverage glass container having no CEC, or a CEC of less than 20 nm between its outer surface and the printed caustic image generator.

10. A method of generating a caustic image from a recipient for containing a beverage, comprising printing a refractive and/or reflective geometry on at least part of the recipient's outer surface, characterized in that the geometry is a caustic image generator.

11. A method according to claim 10, wherein at least the part of the outer surface to be printed upon is cylindrical.

12. A method according to claim 10, wherein the caustic image generator is inkjet printed.

13. A method according to claim 10, wherein the caustic image generator is printed on refractive and/or reflective glass, refractive and/or reflective plastic, reflective metal, or a combination thereof.

14. A method according to claim 10, wherein the caustic image generator is printed as computed by inverse caustic design computing.

15. A method according to claim 10, wherein the transparent recipient provided is a carbonated beverage glass container supporting a CEC at its outer surface, and wherein the method further comprising the step of removing the CEC to a level of less than 20 nm thickness.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/078782

A. CLASSIFICATION OF SUBJECT MATTER
INV. G09F19/12 G09F19/18 G09F19/14
ADD. G09F23/00

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)
G09F G02B A45D B29C

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2004 181037 A (TAKEUCHI KOGYO KK) 2 July 2004 (2004-07-02) the whole document	1-15
X	JP 2007 030967 A (YOSHINO KOGYOSHO CO LTD) 8 February 2007 (2007-02-08) abstract; figures 1-4	1-15
X	US 2013/066596 A1 (PAPAS MARIOS [CH] ET AL) 14 March 2013 (2013-03-14) cited in the application the whole document	1-15
X	WO 2012/093086 A1 (LUXEXCEL HOLDING BV [NL]; BLESSING KURT [DE]; VAN DE VRIE RICHARD [NL]) 12 July 2012 (2012-07-12) cited in the application the whole document	1-15

-/--

[X] Further documents are listed in the continuation of Box C.

[X] 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

"E" earlier application or patent but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"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

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 March 2018	13/03/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pantoja Conde, Ana

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/078782

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2011/011818 A1 (ZYDEX PTY LTD [AU]; ELSEY JUSTIN [AU]) 3 February 2011 (2011-02-03) cited in the application the whole document -----	1-15
X	John Klein: "A", , 1 January 2015 (2015-01-01), XP055342682, Retrieved from the Internet: URL:http://web.media.mit.edu/~neri/MATTER.MEDIA/Theses/John_Klein_MIT_MSc_Thesis_Submission (1).pdf [retrieved on 2017-02-06] cited in the application the whole document -----	1-15
X	WO 2016/000926 A1 (ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE EPFL TTO [CH]) 7 January 2016 (2016-01-07) cited in the application the whole document -----	1-15

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2017/078782

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2004181037 A	02-07-2004	JP 4260467 B2	30-04-2009
		JP 2004181037 A	02-07-2004
JP 2007030967 A	08-02-2007	NONE	
US 2013066596 A1	14-03-2013	US 2013066596 A1	14-03-2013
		US 2016041398 A1	11-02-2016
WO 2012093086 A1	12-07-2012	CN 103459116 A	18-12-2013
		EP 2474404 A1	11-07-2012
		EP 2661345 A1	13-11-2013
		JP 2014502931 A	06-02-2014
		US 2013286073 A1	31-10-2013
		WO 2012093086 A1	12-07-2012
WO 2011011818 A1	03-02-2011	AU 2010278663 A1	23-02-2012
		CN 102481729 A	30-05-2012
		EP 2459361 A1	06-06-2012
		US 2012165969 A1	28-06-2012
		WO 2011011818 A1	03-02-2011
WO 2016000926 A1	07-01-2016	EP 2963463 A1	06-01-2016
		EP 2963464 A1	06-01-2016
		HK 1219781 A1	13-04-2017
		HK 1220011 A1	21-04-2017
		US 2017139204 A1	18-05-2017
		WO 2016000926 A1	07-01-2016