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**A receptacle comprising machine-readable unique identifier codes  
and methods for their application and reading out**

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Field of the invention

The present invention relates to a receptacle having a completely or partially cylindrical lateral surface and comprising a multitude of identical machine-readable unique identifier codes on the lateral surface, a method for applying the multitude of the identical machine-readable unique identifier codes to the receptacle, and a method for reading out at least one of the multitude of the identical machine-readable unique identifier codes on the lateral surface of the receptacle.

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Background of the invention

In the pharmaceutical industry, receptacles having a completely or partially cylindrical lateral surface, in particular syringes, ampoules, vials, cartridges, or bottles, are used as primary packaging and transportation vessels for parenteral drugs. Coding such receptacles with a machine-readable unique identifier code, in particular linear and 2D barcodes, such as a data matrix barcode, a QR barcode, or a linear barcode, would allow identification of each receptacle, a prerequisite for tracking and tracing it. For tracking and tracing, each receptacle will be furnished with an individual identifier code comprising a unique serial number which is registered in a database. Through multiple scanning of the identifier code along a supply chain, the receptacle can be located and its movement registered. Additional information related to the receptacle and its content, such as production process data, can also be registered. As a result, such a coding system appears to be highly attractive, thus, various attempts have been made to realize such a coding system on cylindrical pharmaceutical containers such as syringes, ampoules, vials, cartridges, or bottles.

US 5,397,410 A describes a method for providing machine-readable markings on glassware, wherein a linear barcode is printed on a heat fusing decal, generically denoted as a “ceramic film”. This heat fusing ceramic film is placed on the outer surface of the glassware and heated up to a point at which the ink on the film which contains glass frits melts fuses with the glass surface, whereby an enamel layer is obtained. For this purpose, a silk screen process is used as the printing technology. However, this kind of print technology allows printing static codes only, which are not suitable for track and trace purposes where each label comprises a different code. Additionally, the described process specifies a ceramic film which requires water soaking of the deal to transfer it to the glass surface. Consequently, this process cannot be automatized and is not suitable for industrial use, moreover, since this process requires a drying time of 24 hours.

WO 98/043832 A describes a glass treatment process and apparatus, wherein the soaking of the ceramic film with water may be eliminated. For this purpose, the ceramic film is fixed on the carrier with wax. Heating up that wax layer allows transfer-ring the ceramic film to the glass surface.

5 WO 2012/174545 A1 describes a method for etching glass with laser light for generating a barcode. Herein, the glass may easily be damaged by making cracks. Additionally, the lasers used for this purpose are quite expensive and difficult to operate in an industrial manufacturing environment.

10 US 5,270,522 A describes a dynamic barcode label system comprising a mechanical device adapted for generating variable linear barcodes to be printed on normal decals to at ambient temperatures. However, linear barcodes are too large to be used for syringes and vials.

15 WO 95/32098 A describes a method for printing on a common decal and/or label material with a variable print technology. However, such kinds of labels cannot be burned in as described in US 5,397,410 A above when decal and/or label materials, such as paper or plastic films, are used which are not heat resistant.

20 All above-mentioned prior art documents specify a process for generating a single barcode on the cylindrical surface of a glass container. Reading the barcode on the surface of the cylindrical container is demanding as the item has to revolve until the code is in front of the reading device. The infrastructure for positioning the barcode for the reading process is costly and requires a lot of space. As an example, WO 2013/083544 A1 illustrates the complexity of a readout device.

25 Herein, the readout device has at least one optical detector designed to detect machine-readable markings within a viewing region. The readout device further has at least one roll area and at least one transport device, wherein the readout device is designed to roll the receptacles in succession over the roll area by means of the transport device and, in doing so, to roll at least part of the lateral surface within the viewing region.

30 Problem to be solved

It is therefore an object of the present invention to provide a receptacle having a completely or partially cylindrical lateral surface and comprising a multitude of identical machine-readable

35 unique identifier codes on the lateral surface, a method for applying the multitude of the identical machine-readable unique identifier codes to the receptacle, and a method for reading out one of the multitude of the identical machine-readable unique identifier codes on the lateral surface of the receptacle which at least partially overcome the problems and shortcomings of such methods and devices known from the state of the art.

It is, therefore, a particular objective of the present invention to provide a method which allows an easy reading out of a machine-readable unique identifier code on the lateral surface of the receptacle, thus allowing multiple readings in track-and-trace systems along a supply chain with low technical effort. For this purpose, a readout device would be desirable which would be  
5 capable of reading the machine-readable unique identifier code on the receptacle without any need for rolling the receptacle within a viewing region of at least one code reading camera of a reading station.

#### Summary of the invention

10 This problem is solved by a receptacle having a completely or partially cylindrical lateral surface and comprising a multitude of identical machine-readable unique identifier codes on the lateral surface, a method for applying the multitude of the identical machine-readable unique identifier codes to the receptacle, and a method for reading out one of the multitude of the identical  
15 machine-readable unique identifier codes on the lateral surface of the receptacle with the features of the independent claims. Preferred embodiments, which might be realized in an isolated fashion or in any arbitrary combination thereof, are listed in the dependent claims.

As used in the following, the terms “have”, “comprise” or “include” or any arbitrary  
20 grammatical variations thereof are used in a non-exclusive way. Thus, these terms may both refer to a situation in which, besides the feature introduced by these terms, no further features are present in the entity described in this context and to a situation in which one or more further features are present. As an example, the expressions “A has B”, “A comprises B” and “A includes B” may both refer to a situation in which, besides B, no other element is present in A  
25 (i.e. a situation in which A solely and exclusively consists of B) and to a situation in which, besides B, one or more further elements are present in entity A, such as element C, elements C and D or even further elements.

Further, as used in the following, the terms “preferably”, “more preferably”, “particularly”,  
30 “more particularly” or similar terms are used in conjunction with optional features, without restricting alternative possibilities. Thus, features introduced by these terms are optional features and are not intended to restrict the scope of the claims in any way. The invention may, as the skilled person will recognize, be performed by using alternative features. Similarly, features introduced by “in an embodiment of the invention” or similar expressions are intended to be  
35 optional features, without any restriction regarding alternative embodiments of the invention, without any restrictions regarding the scope of the invention and without any restriction regarding the feasibility of combining the features introduced in such way with other optional or non-optional features of the invention.

In a first aspect, the present invention relates to a receptacle which comprises

- at least one interior for receiving at least one content,
- a completely or partially cylindrical lateral surface at least partially enclosing the at least one interior, and
- 5 – a multitude of successively arranged identical machine-readable unique identifier codes surrounding the lateral surface.

Within the scope of the present invention, the term “receptacle” refers to a device which has at least one interior and which can receive at least one content in the at least one interior. In particular, the receptacles can be selected from the group consisting of syringes, syringe bodies, ampoules, vials, cartridges, or bottles, which may be used as medical containers, pharmaceutical containers, or foodstuff containers. The receptacles may, in principle, be completely closed or else open in full or in part. The receptacles may be produced, in particular, from glass, either completely or partially. Alternatively or in addition, however, other materials may also be used, such as plastic, ceramic, metal or paper. Further according to the present invention, the receptacles are completely or partially rotationally symmetrical, preferably about a single axis of rotation. Consequently, the receptacles in accordance with the present invention are receptacles which are completely or partially cylindrical, in particular syringes having a round cross-section, cylindrical glass receptacles, cylindrical vials, cylindrical syringe bodies, cylindrical bottles having a round cross section, or similar receptacles.

Further, the term “lateral surface” of the receptacle is, in principle, to be understood to mean any surface of the receptacle that closes the receptacle outwardly, either completely or partially. For this purpose, the receptacle may comprise a surface wall which may be adapted to enclose the interior completely or partially, wherein, in the latter case, the receptacle may, further comprise at least one opening adapted for filling and/or dispersing the content. For example, a lateral surface may be an outer surface pointing towards the outer face of the receptacle or an inner surface pointing towards an interior of the receptacle. In particular, the lateral surface may be an outer surface of the receptacle which points away from an interior of the receptacle. As mentioned above, the lateral surface is a completely or partially cylindrical lateral surface, in particular a completely or partially cylindrical lateral surface of a glass receptacle. In particular, the lateral surface may be circular cylindrical. Further, the lateral surface of the receptacle may be transparent, either in full or part. By way of example, the lateral surface of the receptacle may be transparent at least in at least one region in which machine-readable unique identifier codes may be applied to the lateral surface of the receptacle. Alternatively, the lateral surface of the receptacle may be transparent outside the region in which machine-readable unique identifier codes may be applied. However, other possibilities may also be feasible.

Preferably, the receptacle may be a pharmaceutical and/or a diagnostic receptacle having at least one content, especially, at least one pharmaceutical, i.e. a pharmaceutical active ingredient and/or at least one diagnostic agent. However, such receptacles may be used for other purposes in industries, such as in cosmetics, biological research, or crop protection. Alternatively, the  
5   receptacle may also be used such as in the field of food engineering, in particular, when filling foodstuffs into corresponding receptacles.

In particular in the pharmaceutical industry, it is generally required to ensure, especially before, during or after filling therapeutic active ingredients and/or diagnostic agents, that it is possible to  
10   check which pharmaceutical material is comprised by the receptacle at any moment during and/or after the filling of pharmaceutical material, such as at least one medicament. In addition, information concerning the type of filling process, the production date, a dosage, or further items may be of considerable importance, wherein it should be easy to check this information again at a later time, such as when packaging the pharmaceutical receptacles, or by a user of the  
15   pharmaceutical material. Hereby, it is intended to ensure that the receptacles and/or their contents are prevented from becoming confused, even in a filling facility in which different types of pharmaceutical materials and/or pharmaceutical materials having different properties, such as different active ingredient concentrations, are filled.

For this purpose, each receptacle is marked by a machine-readable unique identifier code. As further used herein, the term “machine-readable identifier code” is defined as a representation of data which can be read out by means of a machine, in particular in an optical fashion. Herein, the readability of the data by machine distinguishes the identifier code from any other representation of data, such as printing the data in human readable form. However, although an identifier code  
25   may be read by both a machine and a human being, it may still be considered as an identifier code according to the present invention as long as it can be read by a machine. Once read out, the data may be further processed in digital form. Further, the term “unique”, preferably, indicates that an individual identifier code is used for each individual receptacle. Alternatively, especially outside the pharmaceutical field, an individual identifier code may also be used for a plurality of  
30   receptacles, such as a batch, a lot, or a bundle of receptacles, in particular, receptacles of common origin and/or destination. Preferably, unique identifier codes are generated in a central database which, hereby, simultaneously provides a one-to-one assignment between the receptacle and the corresponding unique identifier code.

Preferably, the unique identifier codes may comprise at least two concatenated strings, in  
35   particular, a global company/product identifier, such as e.g. a GTIN according to the standard GS1 in a version valid at the date of this application, and a unique serial number. However other kinds of data representation may also be provided.

The information comprised by the identifier code may include data related to one or more of addresses, such as at least one sending and/or at least one receiving party, codes, such as bar codes, data matrix codes or QR codes, Electronic Data Interchange (EDI), identification codes or other product codes, such as a universal product code, a Serial Shipping Container Code (SSCC),  
5 Radio-Frequency Identification (RFID) labels, country of origin labels, registration marks, trademarks, symbols for product certifications, proof of purchase marks, notes providing conformance to a regulation, such as to a weight and measures accuracy regulation, e.g. a CE marking, environmental and/or recycling symbols, such as a recycling code, a resin identification code and/or a "Green Dot", special information symbols for hazardous or dangerous goods, food  
10 contact material symbols, such as an oval-shaped EC identification mark, health marks for food safety, quality insurance signs, calibration and/or troubleshooting cues.

In particular, the data encoded in the form of a machine-readable code may be represented, in a linear or a one-dimensional barcode, by using varying widths and/or spacings of parallel lines,  
15 or, in a two-dimensional barcode, by using a particular arrangement of bars, rectangles, squares, hexagons, dots, or any other geometric pattern being distributed in a specific manner over a limited two-dimensional area. World-wide, various standard specifications are used nowadays, however, with regard to the present invention the standard specification may preferentially be selected from the group consisting of:

- 20 – a data matrix barcode, as defined according to ISO/IEC 16022;
- a DotCode barcode as defined according ISO/IEC TR 29158;
- a QR barcode, as defined according to ISO/IEC 18004;
- a MaxiCode as defined according ISO/IEC 16023; and/or
- a linear barcode, as defined according to ISO/IEC 15420;

25 each in a version which is valid at the date of filing of this document. However, other standard or non-standard linear and 2D code specifications may also be applicable, such as a snowflake code or a pdf 417 code.

In a preferred embodiment, the machine-readable unique identifier codes may directly be placed  
30 on the lateral surface of the receptacle, in particular, in a manner that at least one of the identifier codes can be detected and read out from the lateral surface of the receptacle. Preferably, the identifier codes may, thus, be obtained on the lateral surface of the receptacle by using a printing device adapted for printing the unique identifier codes directly on the designated location on the lateral surface of the receptacle. In a particular preferred embodiment, an inkjet printer may be  
35 used for this purpose. Alternatively, the unique identifier codes may be placed on the lateral surface of the receptacle by using an inscription device adapted for inscribing the unique identifier codes directly into the lateral surface of the receptacle.

In an alternative embodiment, the identifier codes may be placed on a substrate, wherein the substrate may, preferably prior to printing or after printing of the identifier codes, be applied to the lateral surface of the receptacle. As used herein, a “substrate” refers to a carrier material which may be attachable to the receptacle and which may, thus, be used for providing the data in form of machine-readable form identifier code. The substrate may be shaped as an adhesive tag or sticker, as such comprising a thin sheet of paper or plastic affixed to a double-sided adhesive layer, which may be attached to the receptacle by using a manual, a semi-automatic or, preferably, an automatic label dispenser. Herein, the substrate may exhibit an optical contrast with regard to the lateral surface of the receptacle, in particular, by employing a thin sheet of a preferably white or bright substrate exhibiting the advantageous optical contrast to the material of the packaging which, in case of a plastic foil, might predominantly show clear, lucent, or (semi-)transparent properties, or in case of metal foil, preferably an aluminum foil, might particularly exhibit highly reflecting properties.

In a particular embodiment, the receptacle may partially or completely be a glass receptacle, in which case the label may, preferably, comprise an opaque heat fusing ceramic film banderole which may be applicable to the lateral glass surface. Heat fusing ceramic films are also denoted as “decals”, wherein, however, decals are, usually, applied at ambient temperature outside the focus of the present invention. Consequently, the term “heat fusing ceramic film” will be used in the following. According to this embodiment, the unique identifier codes may, preferably, be provided on a white, opaque heat fusing ceramic film banderole by applying an appropriate printing device, in particular, an inkjet printer. Herein, a specific glass printing ink may, advantageously, be used. The glass printing ink may contain pigments of glass powder, usually denominated as “glass frits”, which may be embedded in at least one organic and/or inorganic binder. After printing, the banderole may, subsequently, be wrapped around the lateral surface of the receptacle and burned together with the glass receptacle at elevated temperatures, preferably of 550 °C to 700 °C, by which process a label being burned into the lateral surface of the receptacle may be obtained.

In particular contrast to known receptacles which, typically, only have a single identifier code on their lateral surface, the receptacle according to the present invention comprises a multitude of identical machine-readable unique identifier codes which are successively arranged with respect to each other on the lateral surface of each receptacle, whereby a sequence or a one-dimensional array of identical machine-readable unique identifier codes is obtained. As used herein, the term “identical” refers to a multitude of unique identifier codes which comprise the same data and the same representation thereof, thus allowing a code reading camera to read just one of the multitude of the unique identifier codes and, thereby, obtaining the full data comprised by any one of the multitude of the unique identifier codes. Preferably, a predefined area on the lateral surface of the receptacle which is occupied by each of the successively spaced unique identical

identifier codes may assume the same size, whereby small variations may be tolerable. Further, the successively arranged unique identical identifier codes may, preferably, be regularly dispersed or evenly spaced with respect to each other, whereby small variations may also be tolerable here. As a result, the sequence of the, preferably evenly spaced and evenly-sized, identical unique identifier codes is continued until the sequence eventually surrounds the lateral surface along the circumference of the receptacle. In other words, one identical unique identifier code follows each other identical unique identifier code until the lateral surface of each receptacle is, preferably completely, encircled by the sequence. In this regard, a small gap or, alternatively, a small overlap between adjacent identifier codes may be tolerable as long as the respective unique identifier codes may still be machine-readable. By way of example, in a syringe the sequence may, preferably, be applicable directly below a finger flange. As a further example, on a vial the sequence can be applicable around a neck of the vial. Depending on a particular form of the receptacle, at least one particular location for placing the sequence may be found.

Preferably, the predefined area occupied by each of the identical unique identifier codes may exhibit a size which may allow each of the identifier codes to be machine-read entirely in form of a sole recording. In a particularly preferred manner, the size of each of the identical unique identifier codes may occupy a size allowing them to be read by using a single code reading camera, especially a standard code reading camera. A particular advantage of the receptacles according to the present invention may comprise an easy and cost-effective reading of the identifier codes, such as the barcodes, on their cylindrical lateral surface along a supply chain. Hereby, the described arrangement may allow reading the desired unique identifier code assigned to the particular receptacle in any position of the receptacle without any need for rotating the receptacle in front of the code reading camera since the identifier code is repeated several times, such as 4 to 20 times, in particular 5 to 10 times, along the circumference of the receptacle. Moreover, no rolling of at least a part of the lateral surface within a viewing region of the code reading camera is required. Consequently, the identifier code in the receptacles according to the present invention can be read with at least one static code reading camera.

Alternatively, a smartphone having a code reading application, which may also be denoted as an “app”, being configured for transferring a recording of the identifier code to a central database may also be employed. Reading the identifier codes on the glass container applying a small footprint and a cost-effective code reading camera may, thus, allow placing a separate code reading camera before and/or after each process step during a processing of the receptacle in order to perform at least one of: performing automated line clearance, reconciliating used and rejected units, and identifying broken glass containers within the process line. However, further applications may also be feasible.

In a further aspect of the present invention, a method for applying a multitude of identical machine-readable unique identifier codes to a receptacle is disclosed. As described above, the receptacle has a completely or partially cylindrical lateral surface. According to the present invention, the identical unique identifier codes are successively printed, preferably regularly  
5 dispersed in an evenly spaced manner, thereby surrounding the circumference of the receptacle, by using a computer-controlled printing device, particularly selected from a group consisting of continuous inkjet printers, drop-on-demand inkjet printers, laser etching, laser ink activating, laser ink transfer foil printers, and thermo-transfer printers.

10 The unique identifier codes may, preferably, be generated in a central database. Preferably, the unique identifier codes may comprise at least two concatenated strings, in particular, a global company/product identifier, such as e.g. a GTIN according to the standard GS1 in a version valid at the date of this application, and a unique serial number. Such a unique identifier code may be encoded in form of a machine-readable barcode, preferably a 2D code as e.g. data matrix  
15 symbology. Herein, the unique identifier codes are, preferably, printed in a size which may occupy an area adapted to be machine-read entirely in form of a sole recording, in particular, by using a single code reading camera, especially a standard code reading camera.

In a preferred embodiment, the identifier codes, in particular the barcodes, are directly printed  
20 multiple times onto the lateral surface, in particular by using the inkjet printer. In this embodiment in which the identifier codes may be directly printed on a transparent glass surface of the receptacle, at least one object which may be located, as seen from a viewing position outside the receptacle, behind the unique identifier code, such as a plunger of a syringe, may be visible, thereby being capable of disturbing a reading process in a later readout. In this particular  
25 embodiment, an opaque background may, preferably, be printed with respect to the identifier codes in order to provide an opaque background for the identifier codes. As generally used, the term "opaque" may refer to an optical property of the background which is neither transparent nor translucent, thus preventing impinging light from traveling through the opaque background. The opaque background may, thus, in particular allow generating identifier codes having a  
30 controlled contrast between white and black zones, thus, increasing a readability of the identifier codes. However, other kinds of contrasts between other selected colors may also be feasible.

In an alternative embodiment, the unique identifier codes, in particular the barcodes, are printed multiple times on a label, wherein the label may, preferably prior to or after the printing, be  
35 applied to the lateral surface of the receptacle. By applying the computer-controlled printing device capable of printing variable data, preferably an inkjet printer, the unique identifiers codes are printed on a white, opaque heat fusing ceramic film which is used as banderole. A high quality of the fused identifier codes may, in particular, be advantageous for obtaining a good readability of the identifier codes. For each banderole a different unique identifier code may,

preferably, be applied. On each banderole an array of identical, preferably evenly spaced and evenly sized, identifiers codes is printed. The heat fusing ceramic film is thin and soft. Classical label application machines cannot be deployed for applying the heat fusing ceramic films on a cylindrical glass container. Instead, the heat fusing ceramic film must be rolled on the surface of a cylindrical glass container. As described elsewhere herein in more detail, once the heat fusing ceramic film may be rolled on the cylindrical glass container, the ceramic layer may be burned in. For this purpose, the glass container may be heated to a temperature required by the glass printing ink for printing the barcode, preferably of 550 °C to 700 °C, in an oven, thus, fusing the ceramic layer, whereby the printed multitude of identifier codes forms an enamel layer with the glass wall of the glass container. This kind of heat treatment is already known from industrial processes performed in existing annealing ovens.

To support a workflow of this method, a central database may, preferably, provide data storage and data processing services, thus, allowing all actors along the supply chain to download required and to upload generated data.

In a further aspect of the present invention, a method for reading out at least one, in particular exactly one, of sequence of a multitude of machine-readable unique identifier codes as placed on at least one completely or partially cylindrical lateral surface of a receptacle, wherein the unique identifier codes are read out by a code reading camera without rotating the receptacle. As used herein, the term “code reading camera” refers to an optical detector which may be capable of reading an identifier code. As further used herein, the term “standard code reading camera” refers to an optical detector which is capable of reading a standard identifier code as described above, in particular a barcode according to any standard related to a barcode. In a particularly preferred embodiment, the code reading camera is a smartphone camera.

In a checking station, a specific code quality assessment camera may read at least one identifier code on the banderole independent of the direction of the cylindrical glass container, thereby assessing the code quality, such as according to ISO 15415 or ISO/IEC TR 19782 in a version valid at the date of this application for a barcode, to ensure sufficient code quality grade. For assessing the readability all identifier codes may, preferably, be quality assessed, in particular, by revolving the glass receptacle in front of the code quality assessment camera, thus, ensuring sufficient quality of all codes.

For further details concerning the methods as described here, reference may be made to the description of the receptacle elsewhere in this document.

The invention further discloses and proposes a computer program, including computer executable instructions for performing both the method for proving the integrity of the original

outer packaging and the hereto related method for determining the integrity status of the suspect outer packaging, when the program is executed on a computer or a computer network. Preferentially, the computer program may be stored on a computer readable data carrier. Within this regard, the invention further discloses a data carrier having a data structure stored thereon,  
5 wherein the data structure, after loading into a computer or a computer network, is capable of executing any or all methods as disclosed herein. As further used herein, a computer may comprise any device which may be capable of storing data and/or performing calculating steps and/or instructing steps. By way of example, this definition may not only include work stations and notebooks but also application-specified integrated circuits (ASICs) and field-programmable  
10 gate arrays (FPGAs).

Preferably, referring to the computer-implemented aspects of the present invention, one or more of the method steps or even all of the method steps of any or all methods disclosed herein may be performed by using a computer or a computer network. Thus, generally, any of the method steps  
15 including provision and/or manipulation of data may be performed by using a computer or a computer network. Generally, these method steps may include any of the method steps.

The methods and devices according to the present invention are considerably distinguished from known methods and devices according to the state of the art and, thus, provide a number of  
20 advantages with regard to the state of the art.

Summarizing the findings of the present invention, the following embodiments are preferred:

Embodiment 1: A receptacle comprising at least one interior for receiving at least one content, a  
25 completely or partially cylindrical lateral surface at least partially enclosing the at least one interior, and a multitude of successively arranged identical machine-readable unique identifier codes surrounding the lateral surface.

Embodiment 2: The receptacle according to the preceding Embodiment, wherein the identifier  
30 codes are evenly spaced.

Embodiment 3: The receptacle according to any one of the preceding Embodiments, wherein the identifier codes are evenly sized.

Embodiment 4: The receptacle according to any one of the preceding Embodiments, wherein  
35 each of the identifier codes occupies an area which is adapted to be read entirely by a code reading camera, preferably by a single code reading camera without rotating the receptacle.

Embodiment 5: The receptacle according to any one of the preceding Embodiments, wherein the identifier codes comprise one of a data matrix barcode, a QR barcode, or a linear barcode.

5 Embodiment 6: The receptacle according to any one of the preceding Embodiments, wherein the identifier codes comprises a background, wherein the background is opaque.

Embodiment 7: The receptacle according to any one of the preceding Embodiments, wherein the identifier codes are directly placed on the lateral surface.

10 Embodiment 8: The receptacle according to any one of the preceding Embodiments, wherein the identifier codes are placed on a substrate, the substrate being attached to the lateral surface.

15 Embodiment 9: The receptacle according to any one of the preceding Embodiments, wherein the receptacle is a glass receptacle, wherein the substrate comprises a heat fusing ceramic film in form of a banderole, wherein the banderole is applied around the lateral surface.

20 Embodiment 10: The receptacle according to any one of the preceding Embodiments, wherein the receptacle is selected from the group consisting of syringes, ampoules, vials, cartridges, and bottles.

25 Embodiment 11: A method for applying a multitude of identical machine-readable unique identifier codes to a receptacle having a completely or partially cylindrical lateral surface, wherein the identical identifier codes are successively printed by using a computer-controlled printing device, thereby surrounding the lateral surface.

Embodiment 12: The method according to the preceding Embodiment, wherein the identifier codes are printed in an evenly spaced manner.

30 Embodiment 13: The method according to any one the two preceding Embodiments, wherein the identifier codes are printed in an evenly sized manner.

Embodiment 14: The method according to any one the three preceding Embodiments, wherein the identifier codes are printed in a size which occupies an area adapted to be read entirely by a code reading camera, preferably by a single code reading camera.

35 Embodiment 15: The method according to the preceding Embodiment, wherein the identifier codes are printed in a size which occupies an area adapted to be read entirely by a smartphone camera.

Embodiment 16: The method according to any one the five preceding Embodiments, wherein the printing device is a computer-controlled printing device, selected from a group consisting of continuous inkjet printers, drop-on-demand inkjet printers, laser etching, laser ink activating, laser ink transfer foil printers, and thermo-transfer printers.

5 Embodiment 17: The method according to any one the six preceding Embodiments, wherein the identifier codes are directly printed on the lateral surface.

10 Embodiment 18: The method according to any one of the seven preceding Embodiments, wherein an opaque background for the identifier codes is printed.

15 Embodiment 19: A method for applying a machine-readable unique identifier code to a cylindrical glass container in form of a banderole, the banderole being adapted for circumventing the cylindrical body of the glass container, wherein a multitude of identical identifier codes spaced along the banderole is printed on the banderole, thereby allowing reading the unique identifier codes without rotating the glass container.

20 Embodiment 20: The method according to the preceding Embodiment, wherein for each of more than one cylindrical glass container, a different unique identifier code is printed on each of the banderoles.

Embodiment 21: The method according to any one of the two preceding Embodiments, wherein the banderole has a carrier material, the carrier material comprising a heat fusing ceramic film.

25 Embodiment 22: The method according to any one of the three preceding Embodiments, wherein printing the multitude of the identical identifier codes on the banderole is performed by a computer-controlled printing device.

30 Embodiment 23: The method according to the preceding Embodiment, wherein the printing of the multitude of the identical identifier codes on the banderole is performed by an inkjet printer.

35 Embodiment 24: The method according to any one of the five preceding Embodiments, wherein a heat fusing ink is provided, the heat fusing ink being adapted for printing as a heat fusing ceramic film on glass, and wherein the ink melts with a partition of the glass container, thereby forming an enamel layer at the partition of the glass container.

Embodiment 25: The method according to any one of the six preceding Embodiments, wherein the ink melts with a partition of the glass container at a temperature from 550 °C to 700 °C.

Embodiment 26: The method according to any one of the seven preceding Embodiments, wherein the cylindrical glass containers are rotated in a test station in front of an inspection camera, whereby a quality of the printed multitude of the identical identifier codes on the banderole according to a standard is assessed.

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Embodiment 27: The method according to any one of the eight preceding Embodiments, wherein an aggregation for syringes stacked in a tub is supported by registering the multitude of the identical identifier codes on the syringes during a stacking of the syringes and by correlating with a code on the tub.

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Embodiment 28: The method according to any one of the nine preceding Embodiments, wherein a central database supports one, several, or all of the following method steps:

- generating the unique identifier code for being printed on the heat fusing ceramic film;
- transferring the unique identifier code to a banderole manufacturing site, whereby the
- 15 multitude of the identical identifier codes are printed on the heat fusing ceramic film;
- transferring the printed heat fusing ceramic film from the banderole manufacturing site to a glass converter, whereby the banderole is rolled on the cylindrical glass container and fused with the glass body of the glass container;
- uploading quality assessment results for the multitude of the identical identifier codes on
- 20 the glass container;
- registering sub-standard identifier codes being rejected in a code quality assessment process;
- supporting the aggregation of the syringes into the tub, the tub providing a packaging unit for the filling process, and hosting associated identifier code numbers on the syringes and
- 25 the code on the tub;
- providing numbers of aggregated syringes based on the code on the tub;
- associating manufacturing data to the identifier code or checking data on the central database being related to the glass container;
- reading the identifier code by applying a standard barcode decoding camera in at least one
- 30 of a filling process facility, a packaging site and at a point of dispensing; and
- reading the identifier code by applying a smartphone.

Embodiment 29: A method for reading out at least one of a multitude of machine-readable unique identifier codes on at least one completely or partially cylindrical lateral surface of a receptacle,

35 the receptacle comprising a multitude of successively arranged identical machine-readable unique identifier codes surrounding the lateral surface, wherein the unique identifier codes are read out by a code reading camera without rotating the receptacle.

Embodiment 30: The method according to the preceding Embodiment, wherein the code reading camera is a smartphone camera.

#### Short description of the Figures

5

Further optional features and embodiments of the invention will be disclosed in more detail in the subsequent description of preferred embodiments, preferably in conjunction with the dependent claims. Therein, the respective optional features may be realized in an isolated fashion as well as in any arbitrary feasible combination, as the skilled person will realize. The scope of the invention is not restricted by the preferred embodiments. The embodiments are schematically depicted in the Figures. Therein, identical reference numbers in these Figures refer to identical or functionally comparable elements.

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#### In the Figures:

15

Figure 1A schematically illustrates a perspective view of a particular embodiment of a receptacle in form of a syringe which comprises a multitude of successively arranged identical machine-readable unique identifier codes surrounding the lateral surface;

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Figure 1B schematically illustrates a preferred method for applying a multitude of identical machine-readable unique identifier codes to a receptacle in a perspective view;

25

Figure 2 schematically illustrates a stack of heat fusing ceramic films being provided in form of banderoles as well as an associated arrangement of unique identifier codes on each of the banderoles;

30

Figure 3 schematically illustrates a preferred application process for rolling a heat fusing ceramic film on a cylindrical glass receptacle;

35

Figure 4 schematically illustrates a camera and illumination unit arrangement of a reading station;

Figure 5 schematically illustrates the aggregation of syringe serial numbers in a tub; and

Figure 6 schematically illustrates a preferred database infrastructure for supporting a workflow for the methods as described herein.

#### Exemplary Embodiments

Figure 1A illustrates a perspective view of a particular embodiment of a receptacle 110 having a form of a syringe 112, which comprises an interior 114 that is adapted for receiving at least one content, in particular at least one pharmaceutical, i.e. a pharmaceutical active ingredient and/or at least one diagnostic agent. However, other kinds of contents which may be received by the syringe 112 may also be feasible, such as at least one foodstuff.

Further, the syringe 112 as schematically depicted in Figure 1A comprises a cylindrical lateral surface 116 having a surface wall 118 which is adapted for partially enclosing the interior 114 of the syringe 112. In this particular embodiment, the cylindrical lateral surface 116 exhibits a constant distance with respect to an axis 120 of the syringe 112 over a considerable partition 122 of the syringe 112. Further in this particular embodiment, an opening 124 within the surface wall 118 and may allow dispensing at least a part of the content comprised in the interior 114 of the syringe 112 in a controlled manner, such as by engaging a plunger (128) which may be movable here by using a finger flange 126 that is located on an opposite site with regard to the opening 124. Further, the syringe 112 as schematically depicted in Figure 1A may comprise one or more labels (not depicted here) which may be arbitrarily distributed over the lateral surface of the syringe 112 and which may be adapted to provide information being related to the content as comprised in the interior 114 of the syringe 112, in particular, in a human-readable form. Alternatively or in addition, the content on the label may also be provided in machine-readable form.

As further schematically depicted in Figure 1A a sequence 130 comprising a multitude of successively arranged identical machine-readable unique identifier codes 132 are arranged on the lateral surface 116 of the syringe 112 in a manner that they surround the lateral surface 116 along a circumference 134. This kind of arrangement allows easy reading of the unique identifier code 132 by a code reading camera (not depicted in Figure 1A) without any need for rotating the syringe 112 in front of the code reading camera. In particular, an entire reading of the unique identifier code 132 may, thus, be performed in a sole recording by a single code reading camera since the unique identifier code 132 is repeated several times along the circumference 134 of the lateral surface 116 of the syringe 112 and may occupy an area 135 which may, especially, be adapted for this purpose. Depending on the diameter of the syringe 112, typically 4 to 20, preferably 5 to 10, unique identifier code 132 may be used. In the perspective view of the syringe 112 as illustrated in Figure 1A, three successive unique identifier codes 132 are at least partially depicted in an exemplary fashion.

On the syringe 112 as schematically shown in Figure 1A the sequence 130 comprising the multitude of the successively arranged identical machine-readable unique identifier codes 132 may, preferably, be applied directly below the finger flange 126 of the syringe 112. On other kinds of receptacles 110, such as a vial (not depicted here), the sequence 130 can, preferably, be

applied around a neck of the vial. However, depending on a form of the receptacle 110, further locations for placing the sequence 130 may also be feasible.

5 A gap 136 between adjacent codes unique identifier codes 132 may, preferably, be as small as possible, wherein minimal distance requirements regarding quiet zones such as specified by a relevant standard may, however, be observed. Preferably, the identical unique identifier codes 132 may, preferably, be regularly dispersed along the sequence 130. For the unique identifier codes 132 practically almost all barcode symbologies can be used, wherein a two-dimensional barcode having a rectangular or a square area, such as a data matrix barcode or a QR barcode,  
10 appears as being appropriate for regularly filling the sequence 130. However, other kinds of unique identifier codes 132, such as a linear barcode, and other 2D barcodes as a DotCode, a MaxiCode or a snowflake code may also be feasible.

The sequence 130 of the successively arranged identical machine-readable unique identifier  
15 codes 132 may, preferably, be directly placed onto the lateral surface 116 of the syringe 112. For this purpose, a printing device (not depicted here) may be used which may, in particular, be adapted for allowing a computer-controlled printing of variable patterns. Consequently, the computer-controlled printing device may, thus, be used for directly printing a new unique pattern on each of the receptacles 110. Inkjet printers appear to be well-suited for this purpose, wherein  
20 it may, particularly, be advantageous to use a specific glass printing ink for this purpose. However, other kinds of printers may also be feasible. Alternatively, the sequence 130 may be printed on a substrate (not depicted here) which may, preferably prior to the printing or after the printing, be attached to a desired location on the lateral surface 116 of the syringe 112. In this regard, to print a black pattern on white background, which may, for example, be provided by a  
25 white substrate, the printing device may, especially, be adapted for printing at least white and black. A similar arrangement may be used for other at least two colors.

Further, Figure 1B schematically illustrates a preferred method for applying a multitude of identical machine-readable unique identifier codes 132 to a receptacle 110 in a perspective view.  
30 Accordingly, an inkjet printing device may, preferably, be applied in a manner that ink 137 may be provided by printing nozzles 138 comprised by a print head 139 in a fashion that the sequence 130 of the unique identifier codes 132 are printed on the syringe 112 as depicted there. As explicitly shown in Figure 1B, a distance between the print head 139 and the lateral surface 116 of the syringe 112 may be significantly larger compared to usual printing, in particular, due to  
35 the finger flange 126 which may bar a closer approach of the print head 139 to the lateral surface 116 of the syringe 112. By way of example, for printing of the unique identifier code 132 having the area 135 of 4.5 mm x 4.5 mm a distance of 5 mm between the print head 139 and the lateral surface 116 of the syringe 112 may be sufficient.

In a particularly preferred embodiment, the printing nozzles 138 may be adapted to print the unique identifier codes 132 by using two contrasting colors, such as black and white, thus, generating the black unique identifier codes 132 on a white opaque background 140 as depicted in Figure 1B. However, other combinations may also be feasible for the two contrasting colors.

5 The opaque background 140 may, thus, particularly allow increasing a readability of the unique identifier codes 132 located on the lateral surface 116 of the syringe 112.

In a further embodiment, the sequence 130 may be printed on a banderole 141 comprising a heat fusing ceramic film 142. Figure 2 schematically illustrates a stack of the heat fusing ceramic  
10 films 142 in form of the banderoles 141 as well as an associated arrangement of data matrix codes as the exemplary unique identifier codes 132 on each of the banderoles 141. To allow traceability, each of the banderoles 141 comprising the heat fusing ceramic films 142 may, preferably, carry a series of unique identifier codes 132, which may be printed by using a computer-controlled printing device (not depicted here) which can, in particular, print variable  
15 patterns 144, thus, being able to generate a different sequence 130 for each of the banderoles 141. As mentioned above, inkjet printers appear to be well-suited for this purpose, wherein a specific glass printing ink may, advantageously, be used. The glass printing ink may contain pigments of glass powder, usually denominated as “glass frits”, which may be embedded in at least one organic and/or inorganic binder. By application of heat, the glass frits may melt and  
20 fuse with a glass body of the receptacle 110, whereby an enamel layer which is biologically inert and particular resistant against mechanical abrasion and/or chemical stress may be generated, which may, particular, be adapted for receiving parenteral drugs.

Figure 3 schematically illustrates a preferred application process for rolling the heat fusing  
25 ceramic film 142 on a cylindrical receptacle 110. As illustrated there, the heat fusing ceramic film 142 may, preferably, be fixed on a transport tape 146 on top of a first wax layer 148 and covered with a second wax layer 150. Before a roll-on process may be performed, the transport tape 146 may be treated with heat 152 to a temperature which may allow melting both the first wax layer 148 and the second wax layer 150. When the second wax layer 150 which is located  
30 on top of the heat fusing ceramic film 142 may achieve contact with the cold surface wall 118 of the receptacle 110, the second wax layer 150 may col down and may, thus, be capable of gluing the heat fusing ceramic film 142 to the surface wall 110 of the glass receptacle 110. Herein, the first wax film 148 may still be liquid, whereby the heat fusing ceramic film 142 may, thus, be transferred from the transport tape 146 to the glass receptacle 110.

35 Figure 4 schematically illustrates a camera and illumination unit 154 as part of a reading station 156. The reading station may, particularly, be used for checking a quality of the unique identifier codes 132 after being printed on the receptacles 110 since a high quality of the unique identifier codes 132 may, especially, be advantageous in order to obtain a good readability of the unique

identifier codes 132. As shown in Figure 4, the cylindrical receptacles 110 may, preferably, be rotated in the reading station 156 in front of at least one optical detector 158, in particular at least one code reading camera 160 which is adapted for assessing the quality of each of the unique identifier codes 132 as printed on the receptacle 110, in particular, according to ISO 15415 or ISO/IEC TR 19782 in a valid version at the date of this application for a barcode. The reading station 156 may, further, have at least one illumination device 162, such as a line of light-emitting diodes, which may be adapted to completely or partially illuminate a viewing region 164 of the optical detector. Hereby, the viewing region 164 may, preferably, be dimensioned in a manner that the receptacle 110 can be rolled at least once along its entire circumference 134 within the viewing region 164. Herein, a rotation of the glass receptacles 110 can be preformed by using a setup as described in WO 2013/083544 A1. Accordingly, the receptacle 100 is received individualized from slide rails 146 in a fashion that the receptacle 110 rotates about its axis 120 and, simultaneously, moves along the slide rails 146.

Filling lines, typically, use aggregated syringes 112 which may be placed in a vertical position 168 inside a transport container 170, also denominated by the term “tub”. Figure 5 schematically illustrates an aggregation process 172 of a plurality of the syringes 112 into the tub 170, wherein each of the syringes comprises the sequence 130 of the unique identifier code 132 as described above in more detail. Once the plurality of the syringes 112 is placed in the tub 170, the tub 170 may be sterilized, closed and delivered to a pharmaceutical company for further processing. In order to maintain a traceability of the syringes 112, it may, particularly, be advantageous that the syringes are registered in a database during the aggregation process 172 and correlated with a further unique identifier code 174 on the tub 170. Further, data related to the aggregation process 172 may, subsequently or in parallel, be hosted on a central database (not depicted here) and may, thus, be eligible for downloading for a later further production step, such for filling the syringes 112 with the desired content.

Figure 6 schematically illustrates a preferred database infrastructure 176 for supporting a workflow for the methods as described herein. Accordingly, a supply chain related to this workflow may cover a cascade of suppliers, manufacturers and service providers, including but not limited to a provider 178 of the heat fusing ceramic film 142, a glass converter 180 applying the heat fusing ceramic film 142 to the glass receptacle 110, a pharmaceutical company 182 filling the receptacle 110, third party manufacturers 184 manufacturing on behalf of the pharmaceutical company 182, distributors, sales organizations, medical personal 186 and/or patients 188 scanning the unique identifier codes 132, such as by using a smartphone. In the preferred embodiment, in which the sequence 130 of the unique identifier codes 132 may directly be printed onto the receptacles 110, a printing company (not depicted here) may be used instead of the provider 178 of the heat fusing ceramic film 142 and the glass converter 180, hereby simplifying the workflow.

In order to improve the flow of data, application of a central database 190 may, thus, be advantageous, wherein the central database 190 may support one, several, or all of the following processes:

- 5       – generation of the unique identifier codes 132 to be printed on heat fusing ceramic films 142;
- transfer of the unique identifier codes 132 to a banderole 141 manufacturing site, thereby printing sequence 130 of the multitude of the identical identifier codes 132 on the heat fusing ceramic films 142;
- 10      – transfer of the printed heat fusing ceramic films 142 from the banderole 141 manufacturing site to a glass converter 180, thereby rolling the banderoles 141 to be rolled on cylindrical syringes 112 as the receptacles 110 and fused with the glass wall 118 of the syringes 112;
- printing of the unique identifier codes 132 directly in the factory of the glass converter 180 on the syringes 112 by using a printer, in particular an inkjet printer;
- 15      – quality assessment of the unique identifier codes 132 and registering rejected items having sub-standard codes;
- support of the aggregation process 172 of the syringes 112 into a tub 170 as used during the filling process and host the associated unique identifier codes 132 on the syringes 112 and the further unique identifier code 174 on the tub 170; provide of these data to the next production process line;
- 20      – correlate manufacturing process data (e.g. temperature, pressure) to the unique identifier codes 132 by using the central database 190, a local database 192, or by checking receptacle-related data by referring to the central database 190;
- code reading by using at least one standard barcode reading camera 160 in the filling process facility, the packaging site and at the point of dispensing; and
- 25      – reading the unique identifier codes 132 by a smartphone applied by a salesperson, a customers, the medical personal 186 and/or the patient 188.

List of Reference Numbers

|     |                              |       |                                      |
|-----|------------------------------|-------|--------------------------------------|
| 110 | receptacle                   | 5 170 | transport container                  |
| 112 | syringe                      | 172   | aggregation process                  |
| 114 | interior                     | 174   | further unique identifier code       |
| 116 | lateral surface              | 176   | database infrastructure              |
| 118 | surface wall                 | 178   | provider of heat fusing ceramic film |
| 120 | axis of rotation             | 180   | glass converter                      |
| 122 | partition                    | 182   | pharmaceutical company               |
| 124 | opening                      | 184   | third party manufacturer             |
| 126 | finger flange                | 186   | medical personal                     |
| 128 | plunger                      | 188   | patient                              |
| 130 | sequence                     | 190   | central database                     |
| 132 | unique identifier code       | 192   | local database                       |
| 134 | circumference                |       |                                      |
| 135 | area                         |       |                                      |
| 136 | gap                          |       |                                      |
| 137 | ink                          |       |                                      |
| 138 | printing nozzle              |       |                                      |
| 139 | print head                   |       |                                      |
| 140 | background                   |       |                                      |
| 141 | banderole                    |       |                                      |
| 142 | heat fusing ceramic film     |       |                                      |
| 144 | variable pattern             |       |                                      |
| 146 | transport tape               |       |                                      |
| 148 | first wax layer              |       |                                      |
| 150 | second wax layer             |       |                                      |
| 152 | heat                         |       |                                      |
| 154 | camera and illumination unit |       |                                      |
| 156 | reading station              |       |                                      |
| 158 | optical detector             |       |                                      |
| 160 | code reading camera          |       |                                      |
| 162 | illumination device          |       |                                      |
| 164 | viewing region               |       |                                      |
| 166 | slide rails                  |       |                                      |
| 168 | vertical position            |       |                                      |

### Patent Claims

1. A receptacle (110) comprising
  - at least one interior (114) for receiving at least one content,
  - 5       – a completely or partially cylindrical lateral surface (116) at least partially enclosing the at least one interior (114), and
  - a multitude of successively arranged identical machine-readable unique identifier codes (132) surrounding the lateral surface (116).
- 10   2. The receptacle (110) according to the preceding claim, wherein the unique identifier codes (132) are evenly spaced.
3. The receptacle (110) according to any one of the preceding claims, wherein each of the unique identifier codes (132) occupies an area (135) which is adapted to be read entirely in a sole recording by a single code reading camera (160) without revolving the receptacle.
- 15   4. The receptacle (110) according to the preceding claim, wherein each of the unique identifier codes (132) occupies an area (135) which is adapted to be read entirely in a sole recording by a smartphone equipped with a barcode reading application.
5. The receptacle (110) according to any one of the preceding claims, wherein the unique identifier codes (132) comprises one of a data matrix barcode, a QR barcode,  
20       a DotCode, a MaxiCode, or a linear barcode.
6. The receptacle (110) according to any one of the preceding claims, wherein the unique identifier codes (132) comprise an opaque background (140).
7. The receptacle (110) according to any one of the preceding claims, wherein the unique identifier codes (132) are directly placed on the lateral surface (116), or  
25       wherein the unique identifier codes (132) are placed on a substrate, the substrate being attached to the lateral surface.
8. The receptacle (110) according to the preceding claim, wherein the receptacle (110) comprises a glass receptacle (110), wherein the substrate is a banderole (141) comprising a heat fusing ceramic film (142), wherein the banderole (141) is placed  
30       around the lateral surface (116).

9. The receptacle (110) according to any one of the preceding claims, wherein the receptacle (110) is selected from the group consisting of syringes (112), ampoules, vials, cartridges, and bottles.
10. A method for applying a multitude of identical machine-readable unique identifier codes (132) to a receptacle (110) having a completely or partially cylindrical lateral surface (116), wherein the identical identifier codes (132) are successively printed, thereby surrounding the lateral surface (116).
11. The method according to the preceding claim, wherein the unique identifier codes (132) are printed in an evenly spaced manner.
12. The method according to any one of the preceding method claims, wherein the unique identifier codes (132) are printed in a size which occupies an area (135) adapted to be read in its entirety by a code reading camera (160) without rotating the receptacle.
13. The method according to any one of the preceding method claims, wherein the unique identical identifier codes (132) are printed by using a computer-controlled printing device selected from a group consisting of continuous inkjet printers, drop-on-demand inkjet printers, laser etching, laser ink activating, laser ink transfer foil printers, and thermo-transfer printersThe method according to any one of the preceding method claims, wherein the unique identifier codes (132) are directly printed on the lateral surface (116), or wherein the unique identifier codes (132) are printed onto a substrate, wherein the substrate is applied to the lateral surface (116).
14. The method according to the preceding claim, wherein a glass receptacle (110) is used, wherein a heat fusing ink adapted for printing a heat fusing ceramic film (142) is provided, and wherein the heat fusing ink melts with a partition of the glass receptacle (110), whereby an enamel layer at the partition of the glass receptacle (110) is formed.
15. A method for reading out at least one of a multitude of machine-readable unique identifier codes (132) on at least one completely or partially cylindrical lateral surface (116) of a receptacle (110), the receptacle (110) comprising a multitude of successively arranged identical machine-readable unique identifier codes (132) surrounding the lateral surface (116), wherein the at least one unique identifier code (132) is read out by a code reading camera (160) without rotating the receptacle (110).

1/5

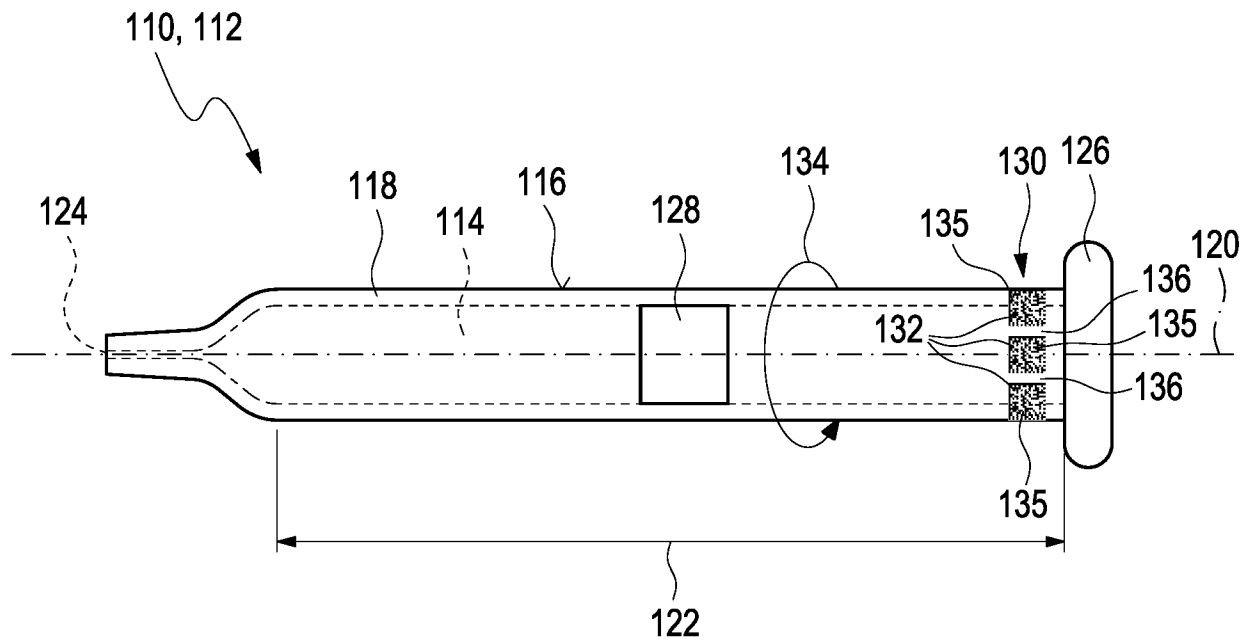


Fig. 1 A

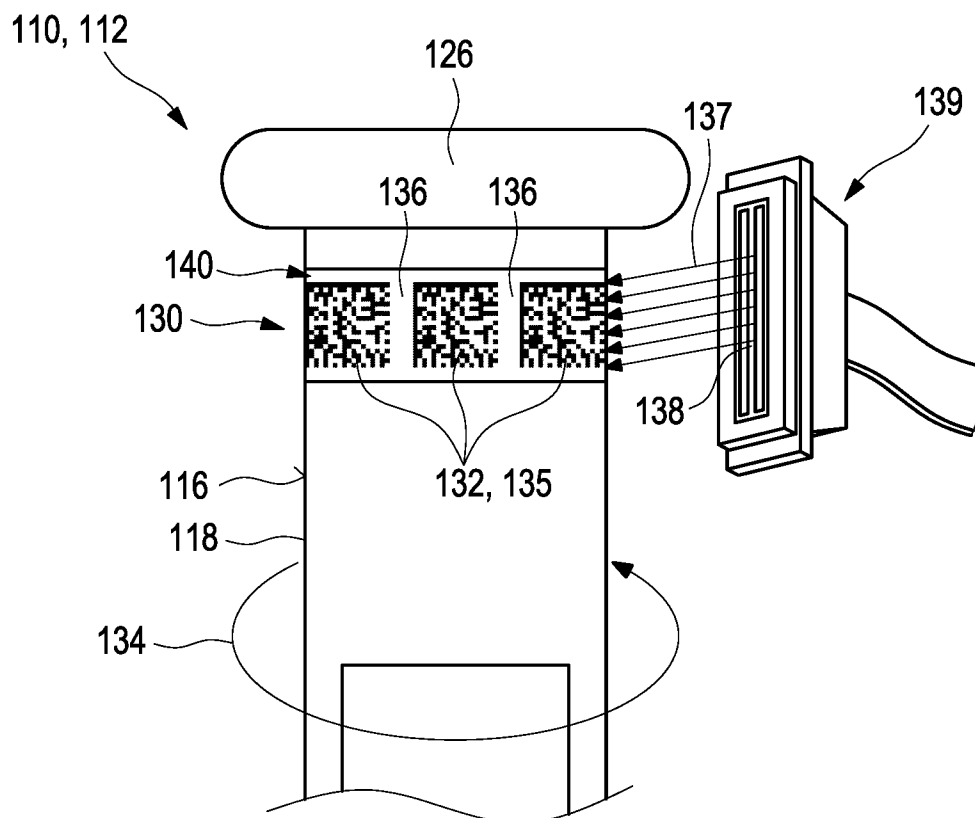


Fig. 1 B

2/5

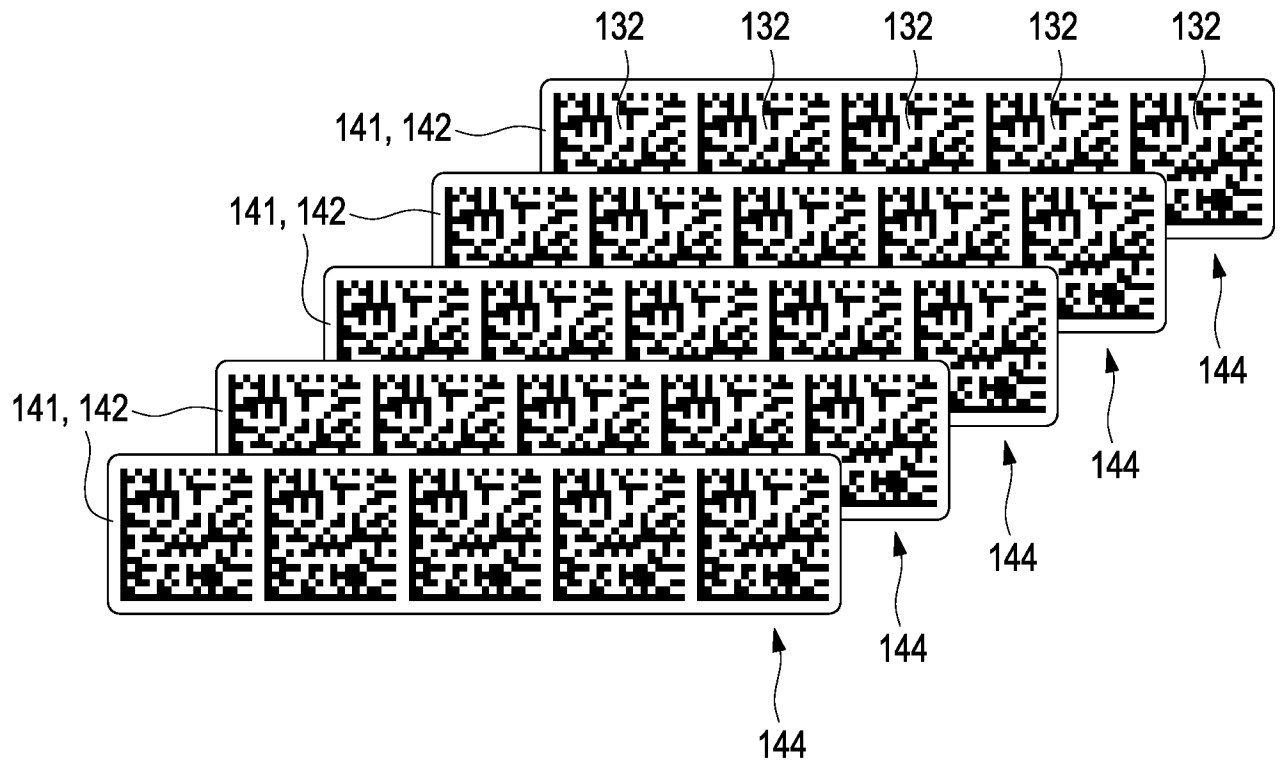


Fig. 2

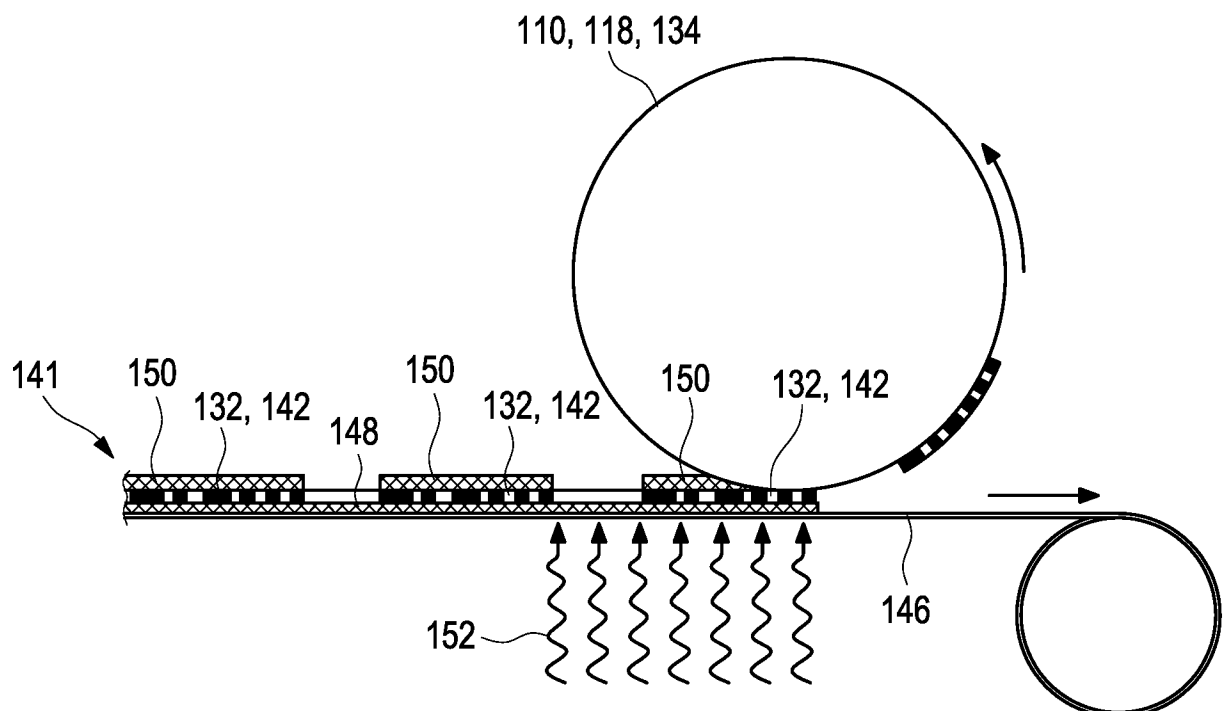


Fig. 3

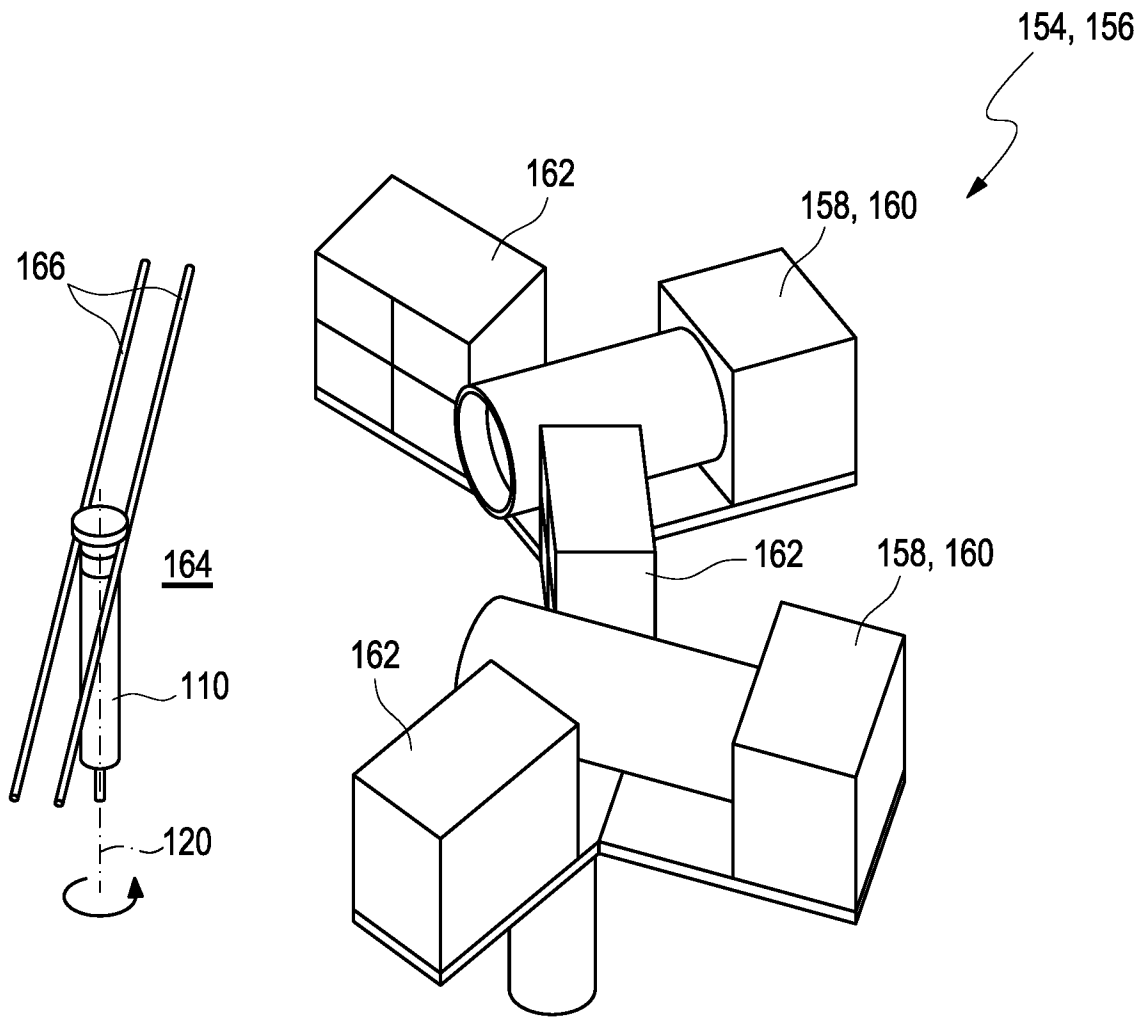


Fig. 4

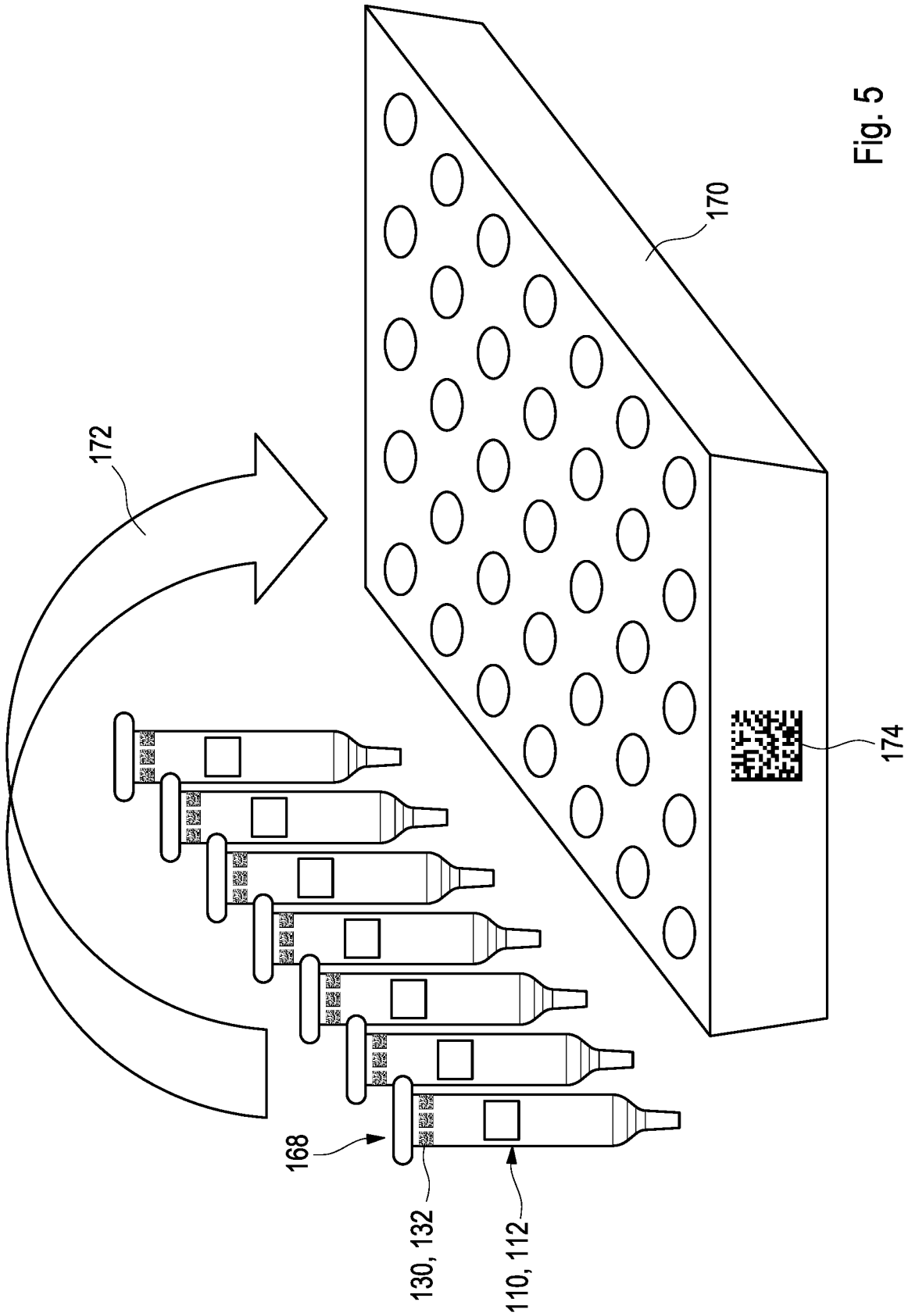


Fig. 5

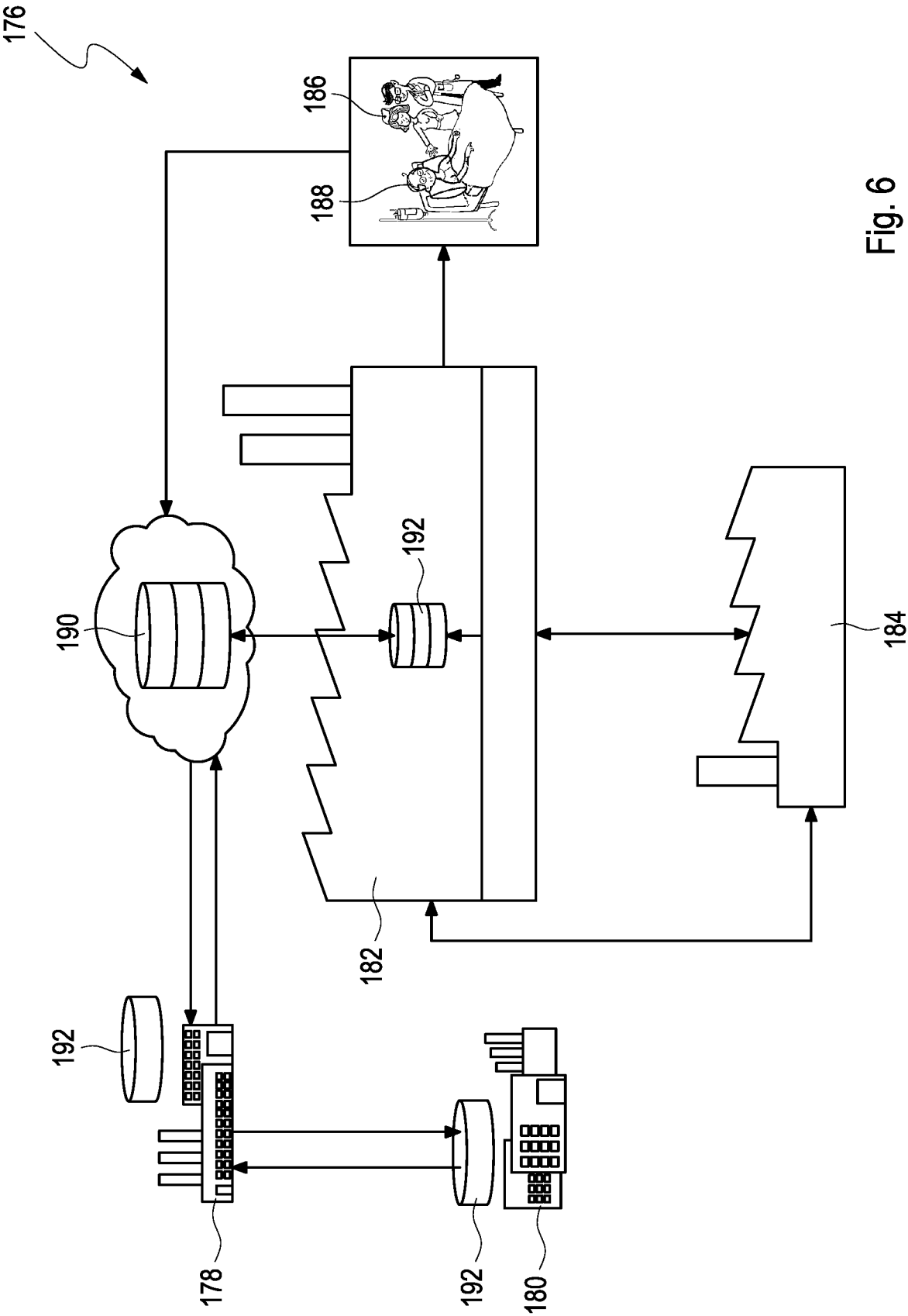


Fig. 6

## INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2017/055642

A. CLASSIFICATION OF SUBJECT MATTER  
 INV. G06K19/06 B01L3/00  
 ADD.

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)

G06K B01L

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         | DE 10 2013 206967 A1 (HAMILTON BONADUZ AG [CH]) 6 November 2014 (2014-11-06)<br>paragraph [0031]; figure 2<br>----- | 1-7,<br>9-13,15       |
| X         | WO 2015/108807 A1 (LABCYTE INC [US])<br>23 July 2015 (2015-07-23)<br>paragraph [0046]; figure 1C<br>-----           | 1-7,<br>9-13,15       |



Further documents are listed in the continuation of Box C.



See patent family annex.

## \* Special categories of cited documents :

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

8 May 2017

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Authorized officer

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/055642

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| DE 102013206967 A1                        | 06-11-2014          | NONE                       |                     |
| -----                                     |                     |                            |                     |
| WO 2015108807 A1                          | 23-07-2015          | CN 106132545 A             | 16-11-2016          |
|                                           |                     | EP 3094406 A1              | 23-11-2016          |
|                                           |                     | JP 2017505902 A            | 23-02-2017          |
|                                           |                     | WO 2015108807 A1           | 23-07-2015          |
| -----                                     |                     |                            |                     |