



(51) International Patent Classification:

G06Q 10/08 (2012.01) G06Q 50/04 (2012.01)

(21) International Application Number:

PCT/EP2020/087377

(22) International Filing Date:

21 December 2020 (21.12.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10 2019 220 554.2

23 December 2019 (23.12.2019) DE

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(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, IT, 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, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, 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))

(54) Title: METHOD AND SYSTEM FOR CONTROLLING ITEMS IN A MANUFACTURING CHAIN

(57) Abstract: A method and system for controlling items in a manufacturing chain is provided. For each item in the chain a unique identification code is defined and printed on the item. A value of a production parameter of the manufacturing chain is recorded in a database on a server after the item enters a manufacturing module equipped with a scanner that reads the unique identification code. The recorded value is associated with the unique identification code. When the code is scanned, access is granted to the value recorded in the database. The recorded value is compared with predetermined acceptable value ranges. If the value is outside of predetermined acceptable value ranges production parameters of the manufacturing module at which the value was recorded are modified.

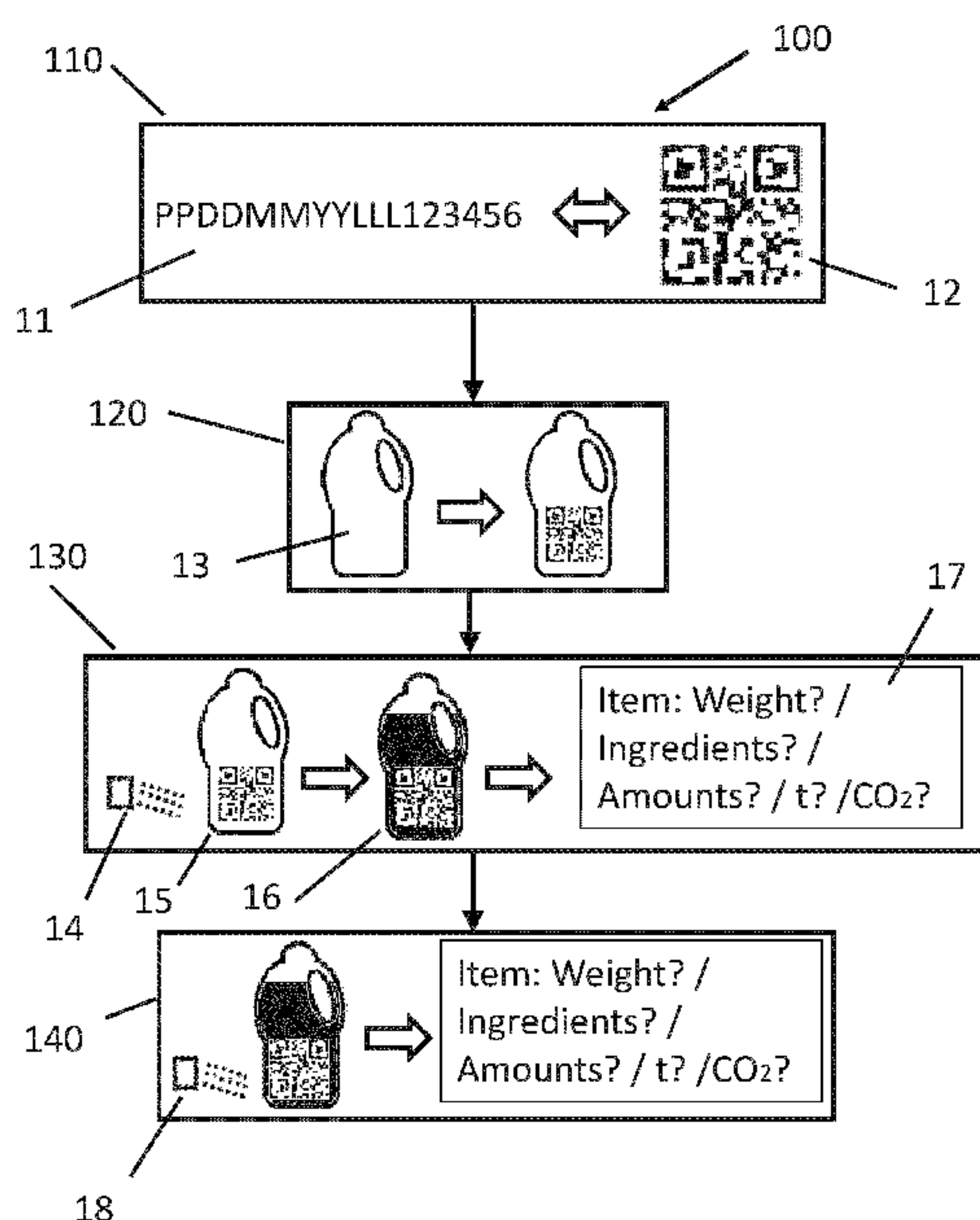


FIG 1

METHOD AND SYSTEM FOR CONTROLLING ITEMS IN A MANUFACTURING CHAIN

TECHNICAL FIELD

The invention relates to the field of tracking and/or controlling of items produced industrially in a supply chain or manufacturing chain typically involving several processing steps. In particular, the invention pertains to the field of controlling the operation of a manufacturing chain in order to ensure that items produced in the manufacturing chain meet predetermined criteria and that the manufacturing chain operates according to standards.

TECHNOLOGICAL BACKGROUND

The manufacturing of items in a manufacturing or supply chain requires an efficient control of all the steps occurring in the production of items from the gathering of raw materials, the manufacturing and processing steps and delivery of a product to a point of sale. Further interaction with customers is also desired, in particular to handle customer services in the event that a product is deemed to be faulty or even dangerous. Tracing individual items back up the supply chain is needed to have a complete overview of the products and their journey through the supply chain.

In order to allow such a tracking of items and control of the manufacturing chain, it is customary to keep records of manufacturing parameters at factories in registries which record events such as the total number of items produced and the consumption of materials that occurred every day. Due to the large amounts of items produced in factories in manufacturing chains or supply chains, identification and tracking of single items is not possible beyond a mere recording of an ID number for the product. This number however cannot be used to reconstruct the whole history of each individual item along the supply chain.

At best, existing methods for tracking items along a supply chain involve the use of reference numbers with storage of certain manufacturing parameters for batches of products. A batch typically comprises from 10 to 10 000 products. Any information available on the history of a batch of items in a supply chain lacks the level of detail necessary to understand possible deviations from standard values in individual items along the supply chain.

Another challenge to track items individually along the supply chain is that items generally undergo many processes during their journey through the manufacturing chain, possibly travelling along different manufacturing modules and different sites.

In order to overcome the above challenges, a method and system to control items in a manufacturing chain is sought.

SUMMARY OF THE INVENTION

To address the above need, the invention provides a method for controlling items in a manufacturing chain, the method comprising, for each item produced in the manufacturing chain:

- defining a unique identification code of the item;
- printing the unique identification code on the item;
- recording, in a database on a server, a value of at least one production parameter of the manufacturing chain used for processing the item at the manufacturing module, the value being recorded in the database in association with the unique identification code, the recording occurring after the item enters a manufacturing module equipped with a scanner that reads the unique identification code on the item to access the database on the server;
- triggering access to the value recorded in the database for the unique identification code upon processing the unique identification code on the item, the processing being one among:
 - a scanning of the unique identification code on the item; entering the unique identification code on a computer connected to a dedicated webpage; opening a webpage comprising the values of the database upon taking a picture of the unique identification code.

The method of the invention provides deeper insights into the functioning of a manufacturing chain and the journey of each individual item in the supply chain from the channeling of raw materials to the delivery of items to points of sale or directly to customers.

Knowledge of the production parameters enables acting on the settings of manufacturing modules in order to make live corrections to faults in the manufacturing chain, or simply identify errors in the supply chain.

One means which enables this deeper insight is to record parameters related to the journey of each item in the supply chain into a database on a server and not by storing the information on the reference number of the item. Due to the large amounts of items processed in manufacturing chain, it is not possible to store all the information into a code that is printed on the package. The link between the database and the item is enabled by a unique identification code which, when scanned, gives access to the database in order to read the information stored in it or write further information into it.

A further implementation of the invention is to access information in the database to store information about production parameters in the database at a first manufacturing module, and then access this written information when the item reaches a second manufacturing module in order to determine whether a change of parameters at this second manufacturing module is required.

Throughout this description, the terms “manufacturing chain” and “supply chain” are used interchangeably and refer to the environment involved in the production of items from the initial steps of the production of each part of the item to the delivery at a point of sale.

5 According to an embodiment, the method may further comprise:

- comparing the value in the database for the unique identification code with predetermined acceptable value ranges;

upon identifying that the value in the database is outside of predetermined acceptable value ranges:

10 - modifying production parameters of the manufacturing module at which the value was recorded.

In other word, beyond a tracking and controlling of items in the supply chain, the method can also enable a control of the manufacturing chain itself. The modification of production
15 parameters typically consists in adjusting the settings of machines that process items along the manufacturing chain so that the features of each item fall back into the predetermined acceptable value ranges. A predetermined acceptable value range typically rests within 0,5% to 5 % of a reference value set for an intrinsic parameter of the item. Intrinsic parameters include for example the weight of the item, a proportion and amount of constituents inside the
20 item.

According to an embodiment, production parameters for which the value is recorded comprise at least one among:

- a reference number of an order for producing the item;

25 - reference values at least for composition, weight, volume of the item;

- a weight of the item;

- a date and time of production of the item;

- a distance travelled by the item;

- a list of constituents found in the item;

30 - a proportion of constituents in the item;

- an amount of energy used to produce the item;

- an amount of greenhouse gas emitted to produce the item;

- a temperature of the air surrounding the item during processing of the item;

- an air pressure at the item during processing of the item;

35 - a humidity of the air surrounding the item during processing of the item;

- a concentration of CO₂ at the item during processing of the item;

- a concentration of pollutants in air surrounding the item during processing of the item.

According to an embodiment, the method may further comprise:

- scanning the unique identification code at a first manufacturing module;
- 5 - recording into the database a value of at least one production parameter of the manufacturing chain used for processing the item at the first manufacturing module, the value being recorded in the database in association with the unique identification code;
- scanning the unique identification code at a second manufacturing module;
- determining, based on the value recorded in the database in association with the unique
- 10 identification code, a change to a production parameter of the manufacturing chain used for processing the item at the second manufacturing module.

According to an embodiment, the method may further comprise:

- scanning the unique identification code on the item prior to delivering the item outside of a
- 15 production site;
- cancelling delivery of the item upon identifying that the value in the database is outside of predetermined acceptable value ranges.

- The method of the invention provides means to identify and filter items that may be considered
- 20 as non-compliant with certain customer standards prior to sending the items to customers or to points of sale.

According to an embodiment, the method may further comprise:

- processing the unique identification code on the item using one among: a scanner at a point
- 25 of sale; a picture taken by a mobile device of a user, a manual input of the unique identification code by a user;
- providing a user with information about production of the item from the database.

In particular information about production of the item may include at least one among:

- 30 - a data and time of production of the item;
- a distance travelled by the item;
- a list of constituents found in the item;
- a proportion of constituents in the item;
- an amount of energy used to produce the item;
- 35 - an amount of greenhouse gas emitted to produce the item.

By providing information about an individual item to the user, the user can, in particular prior to buying an item, check whether the specifications of the production of the item suit his own expectations. Some customers typically wish to reduce their carbon footprint by avoiding consuming products that travelled long distances or were produced with processes that are not environment friendly. Some more unusual customer expectations can also be highlighted by the way customers select their products when they are provided with additional information about the history of a product up the manufacturing chain. Analysis of such customer behavior or evolution of stock at points of sale provides further possibilities for steering the manufacturing chain to meet expectations of consumers. As consumers access the database, the database can log in and store information that a user accessed the information to get further information on customer behavior.

According to an embodiment, the method may further comprise:

- comparing values stored in the database for the item to values stored for other unique identification code associated with other items produces in the manufacturing chain;
- determining a deviation in values of the at least one production parameter from predetermined acceptable value ranges;
- modifying production parameters of the manufacturing module at which the value was recorded.

This approach allows comparison of the values recorded for one item with the values recorded for other items in the manufacturing chain. The average values measured across most items make unusual deviations for individual items more visible. Such events can be the sign of a localized event that triggered the deviation. Inspection of the concerned manufacturing module can be recommended in a message, for example a message that is generated when such deviations are detected. In this respect, the method can also be used to assist live monitoring and maintenance of modules in the manufacturing chain.

According to an embodiment, the unique identification code may be one among:

- a two-dimensional matrix code;
- a quick-response code;
- an RFID antenna;
- a two-dimensional pictogram.

According to an embodiment, the unique identification code may a 16 pixels by 16 pixels two-dimensional data matrix coding an alphanumeric sequence of characters.

According to an embodiment, the method may further comprise:

- recording a value of a concentration of pollutants in air surrounding the item during processing of the item in a manufacturing module of the manufacturing chain;
- 5 - comparing the value of the concentration of pollutants to acceptable threshold values;
- upon determining that the value of the concentration of pollutants is above the acceptable threshold values:
- outputting a message informing personal present at the manufacturing module of a hazardous air quality.

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In other words, monitoring of production parameters and their storage in a database provides insight into the air quality and safety at sites along the manufacturing chain.

The invention also relates to a system for controlling a manufacturing chain, the system

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- comprising:
 - a machine configured to print unique identification codes on items processed at the manufacturing chain;
 - at least one scanner arranged at a manufacturing module of the manufacturing chain, the scanner being configured to read the unique identification code on items after items enter the
 - 20 manufacturing module equipped with the at least one scanner;
 - a server configured to store a database comprising recorded values of at least one production parameter of the manufacturing chain used for processing the item at the manufacturing module, the value being recorded in the database in association with the unique identification code, the recording occurring after the item enters a manufacturing module equipped with a
 - 25 scanner that reads the unique identification code on the item to access the database on the server.

This system is adapted to implement the method described above.

30 According to an embodiment, the system may further comprise a data processing device configured to:

- compare values in the database for the unique identification code with predetermined acceptable value ranges;
- upon identifying that a value in the database is outside of predetermined acceptable value
- 35 ranges:

- modifying production parameters of the manufacturing module at which the value was recorded.

BRIEF DESCRIPTION OF THE DRAWINGS

5 The present disclosure will hereinafter be described in conjunction with the following drawing figures, wherein like numerals denote like elements, and:

Fig. 1 shows a simplified workflow of a method according to an exemplary embodiment;

Fig. 2 is a schematic representation of a manufacturing chain comprising elements of a system according to an embodiment;

10 Fig. 3 is a schematic representation of items comprising a unique identification code at a point of sale and the access a user obtains to data about a single item.

DETAILED DESCRIPTION

15 The invention provides a method for tracking items in a supply chain and more particularly a method that enables a deeper insight into production parameters at modules of a manufacturing chain in order to track and control items produced in the manufacturing chain and also to control the production parameters of the manufacturing chain.

Unlike in existing methods, which track items by placing reference numbers on the items without any further information regarding the conditions under which they are were produced, 20 the invention links a unique identification code printed on of the item to information stored in a database on a server.

In particular, since manufacturing chains process large numbers per minute of items at each manufacturing module, it is not efficient to store and print all the information related to production parameters of each item on the item itself. Typical speeds of processing items in a 25 manufacturing chain amount to 100 to 1000 units per minute, more particularly about 300 units per minute which corresponds to a speed of about 75 meters per minute.

As seen on the flowchart of figure 1, in the method 100 of the invention a unique identification code 100 is defined 110. The code represented on figure 1 is a two-dimensional matrix comprising 16 pixels by 16 pixels, each black or white, to form what resembles a quick 30 response code or QR code. However, the unique identification code 12 can also be a customized pictogram using other symbols than black and white pixels, an antenna having a specific shape, a written alphanumeric code 11.

Advantageously, the unique identification code is selected so that it codes an alphanumeric sequence of the type PPDDMMYYLLL123456. The first two letters PP refer to the factory code 35 at which the item was originally made, DDMMYY code the date with the day, month and year on which the item was produced. LLL codes for a number of a manufacturing line. In the case

of bottles filled with laundry products, LLL designates the filling line. 123456 designates an incremental number of the item. Since about 300 bottles are processed per minute, less than one million bottles will be assigned a number and 6 digits are enough to code for all items produced at one site on one manufacturing line in one day. The incremental number is then
5 reset at 1 on the next day. This code therefore efficiently codes individually every item produced at a manufacturing site that handle about 500 items per minute.

The length of the code can be adapted when the amount of items handled per minute is bigger. In that case, more digits will be used for the unique identification code 12.

The unique identification code 12 is printed 120 at the beginning of the journey of the item 13
10 along the manufacturing chain. On the example represented in the figures, the item is a bottle of detergent. The unique identification code 12 is advantageously printed on the packaging of the item, in the example represented on the bottle of detergent.

As the item 13 moves along the manufacturing chain, whenever the unique identification code 12 is scanned, information about the item 13 can be accessed and stored in a database 17.

15 Production parameters are recorded 130 at a manufacturing module along the manufacturing chain. Many different production parameters can be recorded. Advantageously, the weight of the item 15, 16, an amount of constituents of the composition that is poured into the bottle of the item 15, 16, a list of ingredients that is poured, a timestamp and/or a total time spent by the item since its creation, an amount of greenhouse gases emitted for the production of the
20 item 15, 16 so far. The information is stored on a server which is accessed to write such information in the database 17 when the unique identification code 12 is scanned. A scanner 14, 18 can be placed at different manufacturing modules for that purpose.

Among production parameters that can be recorded, any parameter related to the production of the item or external parameters such as weather conditions can be included. A non-
25 limitative list can for example include parameters such as: a reference number of an order for producing the item; reference values at least for composition, weight, volume of the item, a date and time of production of the item, a distance travelled by the item, a list of constituents found in the item, a proportion of constituents in the item, an amount of energy used to produce the item, an amount of greenhouse gas emitted to produce the item, a temperature of the air
30 surrounding the item during processing of the item, an air pressure at the item during processing of the item, a humidity of the air surrounding the item during processing of the item, a concentration of CO₂ at the item during processing of the item, a concentration of pollutants in air surrounding the item during processing of the item. One example of pollutants that can be monitored includes enzymes in the air to which employees of the manufacturing module
35 are exposed.

Whenever the unique identification code 12 of the item 13,15,16 is scanned, this triggers 140 access to information stored in the database 17.

To further illustrate an implementation of the method of the invention, figure 2 schematically illustrates a manufacturing chain 200 comprising two manufacturing modules 210, 220. A server 230 is also shown. Server 230 does not need to be located at a production site and access to the server can occur wirelessly. Different measuring devices gathering information about the production parameters send information to the server 230 as items travel along the manufacturing chain 200.

In a first manufacturing module 210, a machine 21 that prints unique identification codes 12 onto items 13, 15, 201-205 is shown. As the code is printed, information regarding the creation of the unique identification code 12 is sent to the server 230. Some local information in particular a timestamp can be recorded in association with the unique identification code 12. At a second manufacturing module 220 a scanner 14 scans the unique identification code 12 of each item in order to trigger access to the information stored in the database 17 on the server 230. As the item 201 is filled with detergent, information regarding activation of different filling units can be sent to the server 230 to record the proportion of each ingredient 221, 222, 223 in the bottle that is being filled. Spectroscopic tools such as an infrared spectrometer 23 can also be used to determine the nature and composition of what is poured into the bottles.

A weighing device 22 measures the weight of each item and uploads the information into the database 17 on the server 230.

As can be seen on figure 2, despite automatic settings ensuring very low probability and occurrence of deviations from predetermined acceptable values, it may occur that some items 201-205 are not processed in the same way and do not fulfil the criteria determined and set as reference values for production parameters, in particular the composition, total weight and amount/ratio of ingredients in an item 201-205. In particular it is customary to fix the acceptable deviation from reference values at less than 5%, more particularly less than 1%, even more particularly at less than 0,5% of the reference values. In the example of figure 2, item 203 has an amount of detergent that is considerably lower than in item 202 which can be used in this example as a reference. Item 204 comprises more detergent than item 202.

In order to control items in the manufacturing chain 200 and the manufacturing chain 200 itself, whenever significant deviations are identified, a message informing staff operating on the manufacturing chain 200 can be sent to ask for an inspection of the manufacturing module 210, 220 which seems to be the cause of the deviation.

Should some items 13, 15, 201-205 be considered as non-compliant with quality standards (too much detergent in the bottle, too little detergent in the bottle, a proportion of ingredients

that is not compliant with the specifications of the manufacturer or the presence of pollutants in the bottles) then the thus identified items 13, 15, 201-205 can be removed from the delivery to points of sales or customers.

Furthermore, upon identifying deviations from predetermined acceptable values, in particular if such a deviation is occurring more than once, action can be undertaken at the concerned manufacturing module 210, 220 by changing production parameters for all subsequent items 13, 15, 201-205 that are produced. For example, if the total amount of detergent in bottles tends to be above the reference value that is predetermined for a bottle, the flow of ingredients 221, 222, 223 can be slowed down in manufacturing module 220 proportionally to the excess that is determined without changing the proportion of each ingredient. If it is determined that on average, bottles tend to comprise less detergent than expected according to predetermined reference values, the flow of ingredients 221, 222, 223 can be increased by a proportional amount.

The above can also be implemented to sort items into batches comprising items having similar excess or lack of detergent in their bottles. This can harmonize the items in batches prior to the delivery of items to points of sales or consumers.

By recording different types of information about items 13, 15, 201-205 along their journey through the manufacturing chain 200, it is possible to implement analysis on the gathered data for all items and get a deeper understanding of interaction between different production parameters. It can in particular be possible to identify certain manufacturing lines or production sites that tend to be less energy efficient than others or identify the impact of certain weather patterns on production capabilities. Processing of such information in order to change and optimize production parameters is also made possible with the implementation of the method of the invention.

A data-processing device 231 that is for example part of the server or part of a computer 24 can be used to determine optimization parameters and changes that can be implemented in real-time in order to improve the overall efficiency of the manufacturing chain 200.

The optimization of the manufacturing chain 200 can be implemented in real-time and adapted to each item individually in the manufacturing chain 200. For example, if a first manufacturing module 210 uploads information about a lower than usual amount of a certain ingredient in an item, the same item can be filled with more of a similar ingredient further down the manufacturing chain at a second manufacturing module 220 to compensate for this deviation from the expected value.

The monitoring capabilities of this method also enable to send warnings to staff working at a manufacturing line or facility in case a hazardous situation is detected. For example, if air quality at a manufacturing module 210, 220 is measured and stored in the database 17

comparison with threshold values for air quality can enable an early warning to staff working on the manufacturing chain. If this warning was not given in real-time, storage of variations of pollutants concentrations stored in the database 17 enables preventive and corrective measures to be taken before staff suffers from undesired consequences on their health.

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Another advantage provided by the method of the invention is in the ability to set a more transparent and direct interaction with consumers at points of sales or even further down the journey of the items 12, 15, 201-205.

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Figure 3 shows items 16 displayed on shelves 31 at points of sale. A customer can scan the unique identification code 12 found on an item 16 for example with a mobile device 32 in order to trigger access to a webpage which contains at least some information stored on the server 230 in the database 17. It is possible to reduce the amount of information to which customers have access when they scan the unique identification code 12 from a mobile device 32, as compared to accessing the database 17 by using a scanner 14 at a manufacturing module

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210, 220. For customers, mostly information that is relevant for a more transparent communication on the conditions of the device, in particular the list and proportion of ingredients, the weight, the time since filling of the bottle, the distance travelled or the amount of greenhouse gases emitted for producing and delivering the item 16, an amount of energy used to produce the item 16 can be provided.

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When customers access the database 17 by photographing the unique identification code 12 with a mobile device 32 or by entering the unique identification code manually in case it is an alphanumeric sequence, the information that the database 17 was accessed from outside a manufacturing module can be stored to track items 201-205 after they left a point of sale. A localization of the items 201-205 using geolocalization data of the mobile device 32 scanned the unique identification code 12 or at least an analysis of the number of queries to access the database 17 can provide information about customer needs and behavior, to further optimize operation of the manufacturing chain 200. Further information, targeting customers more specifically can also be further added into the database 17 so that customers may be informed about recycling possibilities for the item 201-205.

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Patterns in accessing the database 17 can also indicate whether the product is an original product or a fake product. In the case of a fake product, an attempt to access the database 17 with the same unique identification code 12 from two remote locations at about the same time would be a strong indication of the existence of an illicit copy. Action can be undertaken to stop the illicit use.

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The steps of the examples and embodiments described above can be implemented by a processor such as a computer. A computer program product comprising steps of the above-described method can be used to implement the method on a computer.

It is possible to store a computer program comprising instructions to implement the method of the invention on different non-transitory computer readable storage mediums. These could for example comprise a processor or chip, FPGA (field programable gate array), an electronic circuit comprising several processors or chips, a hard drive, a flash or SD card, a USB stick, a CD-ROM or DVD-ROM or Blue-Ray disc, or a diskette.

While at least one exemplary embodiment has been presented in the foregoing detailed description, it should be appreciated that a vast number of variations exist. It should also be appreciated that the exemplary embodiment or exemplary embodiments are only examples, and are not intended to limit the scope, applicability, or configuration of the various embodiments in any way. Rather, the foregoing detailed description will provide those skilled in the art with a convenient road map for implementing an exemplary embodiment as contemplated herein. It being understood that various changes may be made in the function and arrangement of elements described in an exemplary embodiment without departing from the scope of the various embodiments as set forth in the appended claims.

Claims:

1. A method (100) for controlling items (13, 15, 16, 201-205) in a manufacturing chain (200), the method comprising, for each item produced in the manufacturing chain:
- defining (110) a unique identification code (12) of the item;
 - 5 - printing (120) the unique identification code on the item;
 - recording (130), in a database (17) on a server (230), a value of at least one production parameter of the manufacturing chain used for processing the item at a manufacturing module (210, 220), the value being recorded in the database in association with the unique identification code, the recording occurring after the
 - 10 item enters the manufacturing module equipped with a scanner (14) that reads the unique identification code on the item to access the database on the server;
 - triggering (140) access to the value recorded in the database for the unique identification code upon processing the unique identification code on item, the processing being one among: a scanning of the unique identification code on the
 - 15 packaging of the item; entering the unique identification code on a computer connected to a dedicated webpage; opening a webpage comprising the values of the database upon taking a picture of the unique identification code.
2. The method according to claim 1, further comprising:
- 20 - comparing the value in the database for the unique identification code with predetermined acceptable value ranges;
- upon identifying that the value in the database is outside of predetermined acceptable value ranges:
- modifying production parameters of the manufacturing module at which the
 - 25 value was recorded.
3. The method according to any one of claims 1 or 2, wherein production parameters for which the value is recorded comprise at least one among:
- a reference number of an order for producing the item;
 - 30 - reference values at least for composition, weight, volume of the item;
 - a date and time of production of the item;
 - a distance travelled by the item;
 - a list of constituents found in the item;
 - a proportion of constituents in the item;
 - 35 - an amount of energy used to produce the item;

- an amount of greenhouse gas emitted to produce the item;
 - a temperature of the air surrounding the item during processing of the item;
 - an air pressure at the item during processing of the item;
 - a humidity of the air surrounding the item during processing of the item;
 - 5 - a concentration of CO₂ at the item during processing of the item;
 - a concentration of pollutants in air surrounding the item during processing of the item.
4. The method according to any one of the preceding claims, further comprise:
- 10 - scanning the unique identification code at a first manufacturing module;
 - recording into the database a value of at least one production parameter of the manufacturing chain used for processing the item at the first manufacturing module, the value being recorded in the database in association with the unique identification code;
 - 15 - scanning the unique identification code at a second manufacturing module;
 - determining, based on the value recorded in the database in association with the unique identification code, a change to a production parameter of the manufacturing chain used for processing the item at the second manufacturing module.
- 20
5. The method according to any one of the preceding claims, further comprising:
- scanning the unique identification code on the item prior to delivering the item outside of a production site;
 - cancelling delivery of the item upon identifying that the value in the database is
 - 25 outside of predetermined acceptable value ranges.
6. The method according to any one of the preceding claims, further comprising:
- processing the unique identification code on the item using one among: a scanner at a point of sale; a picture taken by a mobile device of a user, a manual input of
 - 30 the unique identification code by a user;
 - providing a user with information about production of the item from the database.
7. The method according to claim 6, wherein information about production of the item includes at least one among:
- 35 - a data and time of production of the item;
 - a distance travelled by the item;

- a list of constituents found in the item;
- a proportion of constituents in the item;
- an amount of energy used to produce the item;
- an amount of greenhouse gas emitted to produce the item.

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8. The method according to any one of the preceding claims, further comprising:

- comparing values stored in the database for the item to values stored for other unique identification code associated with other items produces in the manufacturing chain;
- determining a deviation in values of the at least one production parameter from predetermined acceptable value ranges;
- modifying production parameters of the manufacturing module at which the value was recorded.

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9. The method according to any one of the preceding claims, wherein the unique identification code is one among:

- a two-dimensional matrix code;
- a quick-response code;
- an RFID antenna;
- a two-dimensional pictogram.

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10. The method according to any one of the preceding claims, wherein the unique identification code is a 16 pixels by 16 pixels two-dimensional data matrix coding an alphanumeric sequence of characters.

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11. The method according to any one of the preceding claims, further comprising:

- recording a value of a concentration of pollutants in air surrounding the item during processing of the item in a manufacturing module of the manufacturing chain;
- comparing the value of the concentration of pollutants to acceptable threshold values;
- upon determining that the value of the concentration of pollutants is above the acceptable threshold values:
 - outputting a message informing personal present at the manufacturing module of a hazardous air quality.

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12. A system for controlling a manufacturing chain (200), the system comprising:

- a machine (21) configured to print unique identification codes (12) on items (13, 15, 16, 201-205) processed at the manufacturing chain;
- at least one scanner (14) arranged at a manufacturing module (210, 220) of the manufacturing chain, the scanner being configured to read the unique identification code on items after items enter the manufacturing module equipped with the at least one scanner;
- a server (230) configured to store a database (17) comprising recorded values of at least one production parameter of the manufacturing chain used for processing the item at the manufacturing module, the value being recorded in the database in association with the unique identification code, the recording occurring after the item enters a manufacturing module equipped with a scanner that reads the unique identification code on the item to access the database on the server.

13. The system of claim 12 further comprising a data processing device (231) configured to:

- compare values in the database for the unique identification code with predetermined acceptable value ranges;

upon identifying that a value in the database is outside of predetermined acceptable value ranges:

- modifying production parameters of the manufacturing module at which the value was recorded.

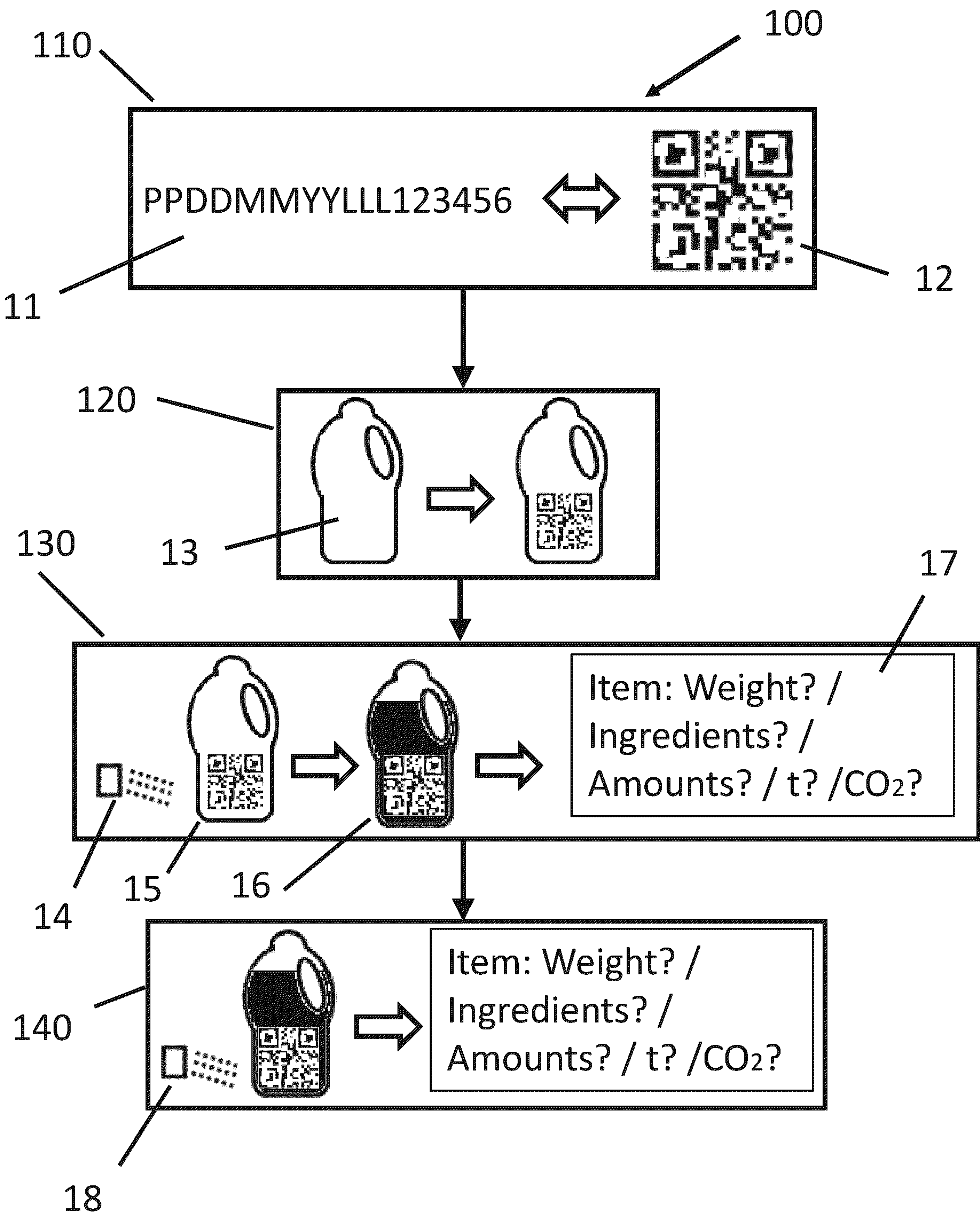


FIG 1

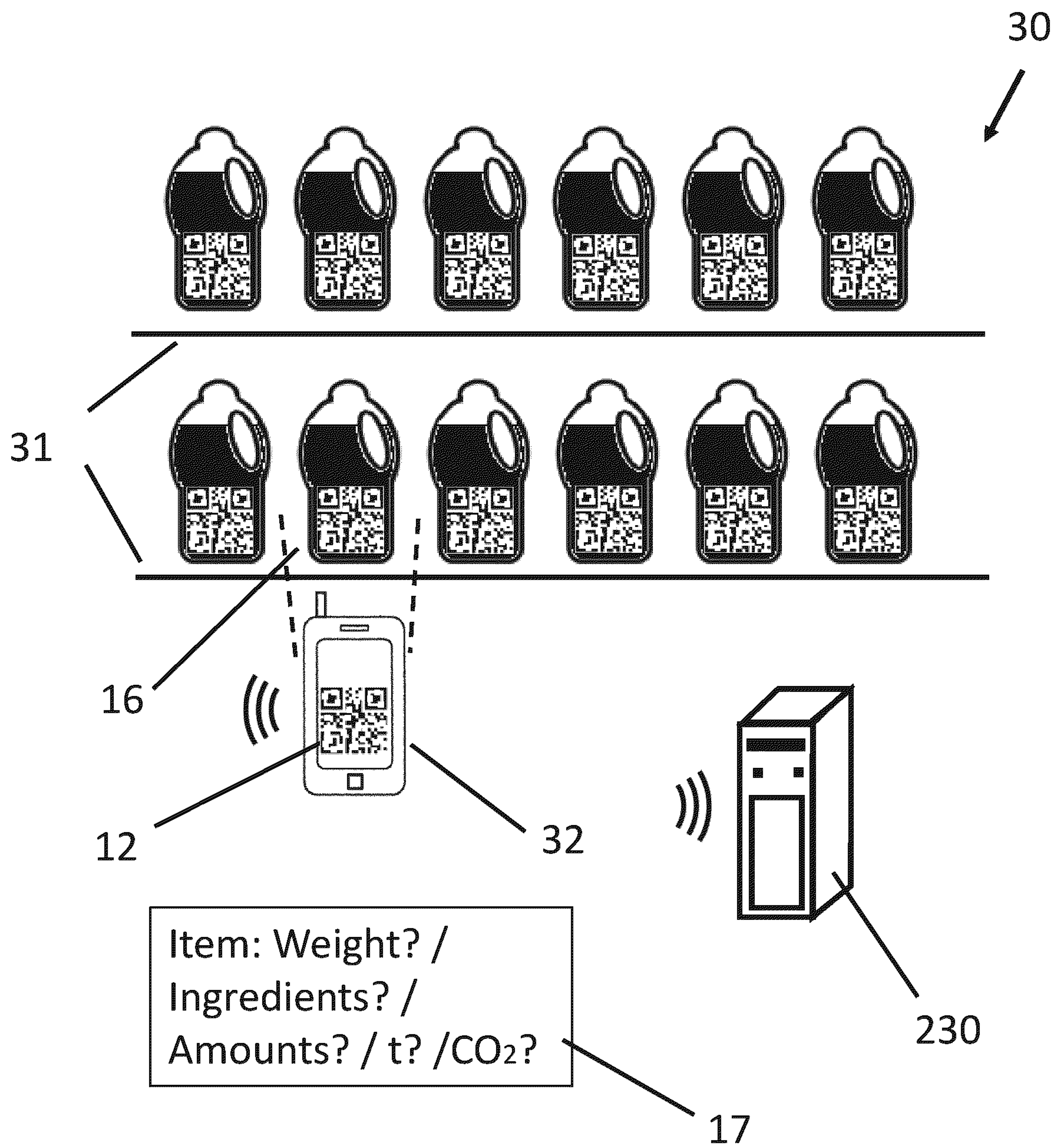


FIG 3

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2020/087377

A. CLASSIFICATION OF SUBJECT MATTER

INV. G06Q10/08 G06Q50/04
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)

G06Q

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	Anonymous: "Barcode - Wikipedia", ' 16 December 2019 (2019-12-16), pages 1-28, XP055772315, Retrieved from the Internet: URL:https://en.wikipedia.org/w/index.php?t itle=Barcode&oldid=931055373 [retrieved on 2021-02-04] page 1 - page 6	1-13
X	----- US 2007/119954 A1 (BARENBURG RONALD [US] ET AL) 31 May 2007 (2007-05-31) abstract figures 1,11 paragraph [0001] - paragraph [0071] ----- -/-	1-13



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"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

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"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

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Date of the actual completion of the international search

5 February 2021

Date of mailing of the international search report

16/02/2021

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/087377

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Anonymous: "Electronic Product Code - Wikipedia", 5 August 2019 (2019-08-05), XP055772308, Retrieved from the Internet: URL:https://en.wikipedia.org/w/index.php?title=Electronic_Product_Code&oldid=909480410 [retrieved on 2021-02-04] the whole document -----	1-13
X	US 8 533 075 B1 (SAYERS III FOSTER JOSEPH [US] ET AL) 10 September 2013 (2013-09-10) abstract figure 1 column 1, line 52 - column 4, line 45 -----	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2020/087377

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			US 8756124 B1	17-06-2014
			WO 2014126654 A1	21-08-2014
