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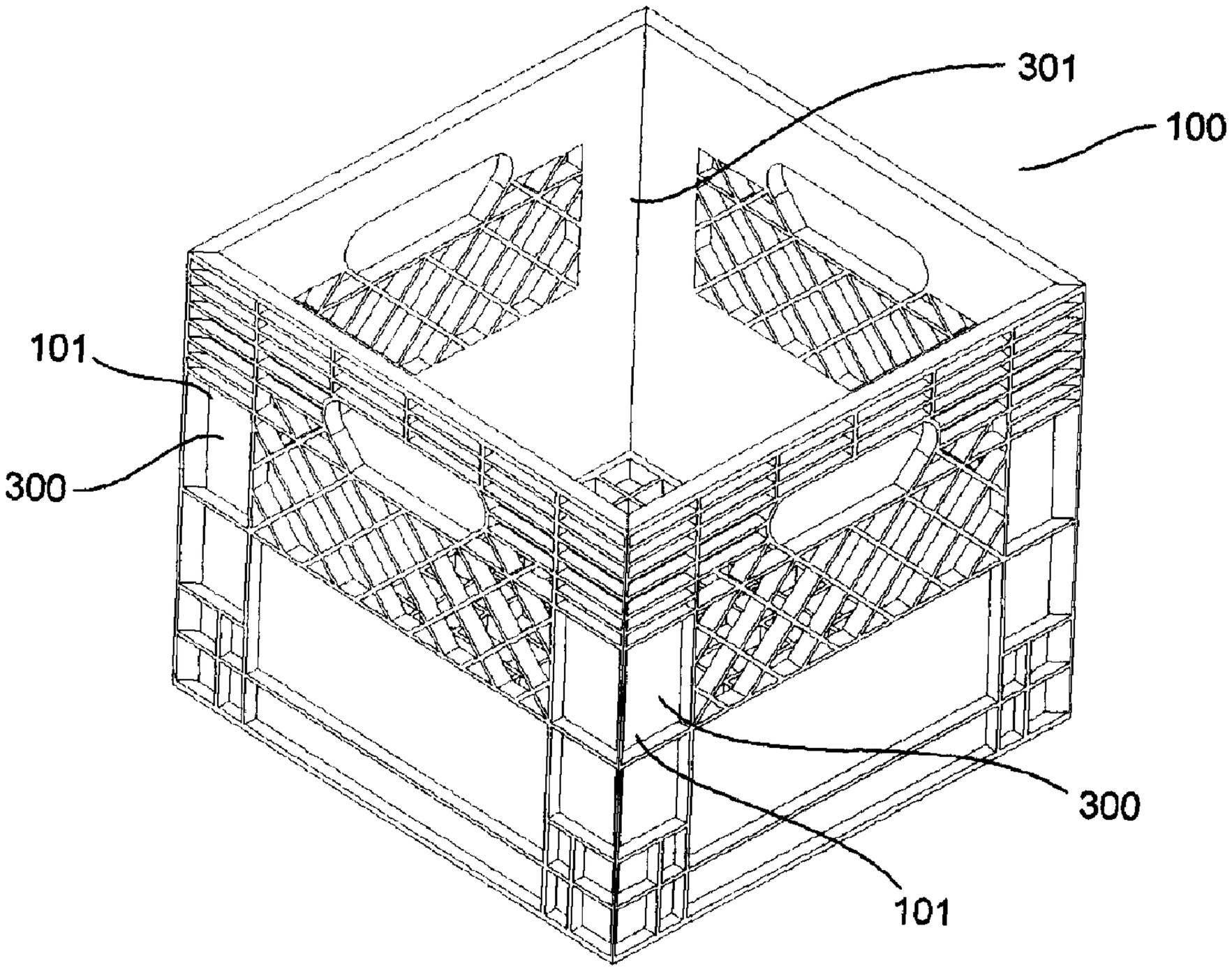
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(54) Titre : METHODE ET SYSTEME D'IDENTIFICATION ET DE SUIVI DE CAISSES DE LAIT EN PLASTIQUE REUTILISABLES

(54) Title: A METHOD AND SYSTEM FOR IDENTIFYING AND TRACKING REUSABLE PLASTIC MILK CRATES



(57) Abrégé/Abstract:
The invention provides a method and system for permanently and visibly marking reusable plastic milk crates with a unique mark and using said mark to identify and track the crate in a manufacturing environment. The aforementioned mark consists of a two-

CA 2676009 A1 2011/02/24

(21) 2 676 009

(13) A1

(57) Abrégé(suite)/Abstract(continued):
dimensional barcode comprised of holes which is drilled through the plastic side walls of the crate producing a unique and permanent pattern for identification. The contrast of the drilled pattern provides good visibility for an optical barcode reader. Said reader can identify a crate uniquely and assign waypoint data, process management data, and content data into a coupled computer database. The drilled pattern by means of an optical barcode reader can also be used to recall associated crate data from a coupled computer database. The ability to assign and recall crate specific data by means of a coupled computer database provide tracking capabilities and beneficial business intelligence for manufacturing management systems.

ABSTRACT OF THE SPECIFICATION

The invention provides a method and system for permanently and visibly marking reusable plastic milk crates with a unique mark and using said mark to identify and track the crate in a manufacturing environment. The aforementioned mark consists of a two-dimensional barcode comprised of holes which is drilled through the plastic side walls of the crate producing a unique and permanent pattern for identification. The contrast of the drilled pattern provides good visibility for an optical barcode reader. Said reader can identify a crate uniquely and assign waypoint data, process management data, and content data into a coupled computer database. The drilled pattern by means of an optical barcode reader can also be used to recall associated crate data from a coupled computer database. The ability to assign and recall crate specific data by means of a coupled computer database provide tracking capabilities and beneficial business intelligence for manufacturing management systems.

Title

A METHOD AND SYSTEM FOR IDENTIFYING AND TRACKING REUSABLE PLASTIC MILK CRATES.

Inventor

Cameron Lanning Cormack

BACKGROUND OF THE INVENTION

In most manufacturing and packaging facilities, multiples of finished products are often packed into a cardboard case. The case is permanently marked with pre-printed artwork, labels, inkjet printers, or lasers to identify the contents of the case. Often variable data is also applied to the case that indicates other important information such as batch number, lot codes, date codes, time codes, case contents, barcodes, and facility information. This information can be collected at various locations throughout the manufacturing process by means of Automatic Identification and Data Capture systems. The captured data can be used in Operations Execution Systems such as manufacturing execution, warehouse management, and supply chain management to name but a few. Not only is this marked data helpful to the manufacturer and customer, but is sometimes required for public health and safety.

Once the case of product is consumed by the customer, the cardboard exterior is often discarded along with all of the markings. The function of the case and its markings has served its purpose therefore disposal is an acceptable outcome at this point in the lifecycle of the packaging. Direct reuse of the cardboard case is not feasible as it was permanently

marked with data that would be no longer valid for other contents of product. This type of case is referred to as a one-time-use case.

In the milk industry, an effort is made to reduce packaging costs by using reusable plastic cases called milk crates. Typically a milk crate can be reused hundreds of times before reaching the end of its lifecycle thus is referred to as a multi-use or reusable case. An industry standard crate design is used to hold various types of milk products. It is difficult to mark the plastic milk crate in the same way cardboard cases are marked due to the design and material of the crate as well as its reusability.

There are three obstacles to marking a plastic milk crate: physical restrictions of existing marking technologies, cost, and variability of data to mark. This inability to mark the plastic crate with relevant information about the current contents leaves milk product manufactures at a strategic disadvantage over the one-time-use cardboard case systems employed in other industries.

If one were to permanently mark the contents of the crate on the exterior sides of the crate, then the crate could not be used for all products and variable data marking would not be available. If one were to temporarily mark the contents of the crate on the exterior sides of the crate, then the crate could not be reused as current techniques for removable markings are not consistent and feasible. Removable markings would be labels and ink based solutions. Because of these limitations the only feasible approach to marking a crate is to permanently mark a unique identifier, and then associate the contents and variable data to the unique identifier in a database.

There are two well known techniques to permanently mark plastic crates. A crate can be mechanically tagged with a Radio Frequency Identification, called RFID, chip or with using an industrial laser marking device. The RFID chip is expensive and is met with strong resistance from the milk packagers based on cost considerations. RFID technology also has limitations with respect to effective reading when placed around liquids. As most of the milk crate contents are liquid products, effectiveness of RFID as an identification technology is diminished. In some cases a RFID tag can become dislodged from the crate due to the harsh handling of the milk crate during normal wear and tear.

The alternative method is with laser marking of the plastic. Unfortunately laser marking of plastics is not a consistent method. The formulation and color of the plastic changes the effectiveness of the laser marking process. Millions of existing crates are in active circulation and effectiveness of laser marking on these crates would be a large uncertainty for the milk packager.

Laser marking marks the surface of plastic with minimal penetration into the body of the material. This means that the entire mark exists only on the outer surface of the crate. Milk crates often experience harsh handling and scratching of the surface. A laser mark can be easily damaged by such a scratch thus rendering the accuracy of the laser mark unacceptable. Therefore both laser marking and RFID methods are either too costly or too ineffective at producing robust and easily readable identifications.

Milk product manufacturers have not adopted any of the prior art identification methods, therefore plastic milk crates are not uniquely identifiable. This also implies that the milk product manufacturer is unable to track crated product through its manufacturing

process. In addition, the manufacturer cannot determine the contents of a plastic crate once it is packed without an employee looking inside the crate and manually recording it. Without the ability to identify the contents of the crate from the outside of a crate, in a machine readable format, then limited mechanical automation can be implemented to handle logistics of the reusable plastic milk crates within the manufacturing process.

Another inability of the milk products manufacturer is accurate recording of final destination for specific product outside their organization, also referred to as track and trace. Without the ability to uniquely identify a crate of product, the manufacturer cannot correlate shipping data to specific product. This would be helpful for milk products manufacturers to recall product from specific end users without having to do a recall from all customers.

SUMMARY OF THE INVENTION

A method and system for uniquely identifying and tracking plastic reusable milk crates is provided. The milk crate is given a unique identifier code that is drilled into the plastic which comprises the crate. This process eliminates all material costs for the unique identifier code, thus overcoming the cost drawbacks of ink, label, and RFID methods.

The unique pattern of drilled holes is also a permanent mark. These holes cannot be reasonably removed from the crate thus overcoming the permanency limitations of ink, labels, and RFID tags. In addition, the contrast achievable for optical inspection is high due to the fact that the holes are spots of absent material thus always producing a contrast with the remaining material, regardless of material color and composition. Removing the material by means of drilling eliminates the visible contrast limitations of laser marking. Black plastic

reflects more light than a void, therefore lighting conditions can be achieved to produce marking contrast visibility for the drilled holes. Surface scratching would yield insignificant alteration to the drilled mark pattern since the holes penetrated all the way through the plastic crate wall.

The holes are drilled with a computer numeric controlled, called CNC, machine with a spindle and an attached drill bit. The CNC drilling machine drills patterns that represent unique serial numbers for the plastic crates. The drilled pattern is produced on all sides of the crate allowing identification from any side.

A computer system with a database of all possible serial numbers is maintained to keep track of the serial numbers that have or have not been used in crate marking as well as other pertinent information about the crates. This database is used to determine the patterns that the CNC drilling machine will create. The unique mark is optically visible and is able to be read through known methods of two dimensional barcode reading. New and existing crates equally can have the unique drilled pattern applied as material and color have no significance on the ability to produce or read the code. A known restriction of drilled patterns is that all of the elements of the unique mark are circular in shape and solid in appearance. Such a circular solid shape is called a dot. This would eliminate the use of barcode technologies that cannot use dot marks solely in the pattern. Many known two-dimensional symbologies exist in the public domain that can exclusively use dots for marks such as Data Matrix and Dot Code A.

Optical barcode readers can be placed at various strategic locations within the milk products manufacturing process. The optical barcode reader would be electronically coupled

to a computer driven database. The crate passing an optical barcode reader would produce a log entry into the database containing specific data regarding the crates identification and stage of the manufacturing process. Other manufacturing processes can use the optical barcode reader to identify the crate's unique code and recall stored information about the crate from the coupled database. Recalled data can be used for routing or other automated processes where the content of the crate is relevant.

A terminal coupled to the database provides an access point for independent queries of the crate data. Management computer systems coupled to the database provides the ability to query the data and produce information relevant to the manufacturing process.

An optical barcode reader positioned at order fulfillment stations could produce database records that would associate crate identification with specific customer details. The association provides a means of tracking specific product forward and backward in the distribution of the milk products.

BRIEF DESCRIPTION OF DRAWINGS

In the drawings, which form a part of this specification,

Figure 1 is a perspective view of a typical reusable plastic milk crate;

Figure 2 is a front view of an embodiment of a two-dimensional code in which the protocol of the code is depicted;

Figure 3 is a perspective view of Figure 2 with a two-dimensional code drilled into each side;

Figure 4 is a front view of Figure 2 depicting an alternate embodiment of a two-dimensional code in which a unique pattern is demonstrated;

Figure 5 is a close-up front view of Figure 3 depicting the drilled identification pattern in the sidewall of the crate;

Figure 6 is a close-up front view of Figure 3 depicting the interaction of light and optical contrast on the drilled identification pattern in the plastic wall of the crate as seen by an optical barcode reader;

Figure 7 is a flowchart depicting the process of assigning and recovering serial numbers for use in marking plastic reusable milk crates;

Figure 8 is a flowchart depicting the process of using the identification mark to track the crate;

Figure 9 is a flowchart depicting the use of the unique identification mark to identify the crates content and the use of said information to transition ownership of product from one business unit to another within the same firm;

Figure 10 is a flowchart depicting the process of using crate identification and tracking methods to automatically record inventory levels; and

Figure 11 is a flowchart depicting the process involved in tracking specific crate contents forward to an identifiable customer.

DETAILED DESCRIPTION OF THE INVENTION

The following is a detailed description of the embodiments of a method and system for identifying and tracking reusable plastic milk crates as shown in the attached figures. Wherever possible, the same reference numbers shall be used throughout to refer to the same or similar elements.

Figure 1 illustrates a typical plastic reusable milk crate 100 that comprises the industry dimensional standard. It is known in the art that crates from different manufacturers may differ slightly in structural layout of the side and bottom panels, but the spirit of the crate design remains constant. The composition and color of the plastic of which the crate is made is not relevant to the present invention as these elements have no bearing on the method described herein. Typical milk crates 100 have side designs that include structural gusset areas 101 that are flat and provide space for a two-dimensional barcode.

Figure 2 illustrates one embodiment of a simplistic two-dimensional barcode layout 200 comprised of columns and rows which defines the marking field. This embodiment is comprised of three dots 201 in the corners of the matrix used for registration of the field of the barcode. The fourth corner 202 remains empty as an orientation indicator for the registration design. The remaining thirty two dots are representative of binary data bits. The figure details the bit location as numbers in the circles. The decimal value of the barcode as illustrated in figure 2 is zero or can be otherwise expressed as a thirty two bit binary value "00000000000000000000000000000000".

Figure 3 illustrates a typical milk crate 100 with a two-dimensional barcode 300 drilled into a structural gusset 101. The drilled holes that comprise the barcode marking method pass completely through the gusset material and leave a reversed pattern on the inside

301 of the crate. The barcode 300 pattern is drilled on all four sides of the crate 100 to increase access to the barcode 300.

A CNC drilling machine by means of a drill bit or end mill can effectively pierce the plastic sidewall material to produce the required through holes. Alternately other CNC machines such as a CNC Laser cutter and CNC Punching machine are also capable of producing said through holes. The method the different types of CNC hole making machines may use differs, but the spirit of the hole making process remains the same. Said machines are capable of removal of plastic material to produce a circular hole clear through the sidewall of the crate. Alternately, other embodiments of a barcode symbology could be utilized such as Data Matrix or Dot Code A, to name but a few.

Figure 4 illustrates the barcode layout 200 as depicted in figure 3. The drilled holes in figure 3 are depicted in figure 4 as filled circles 400. Bit locations nineteen, twenty one, twenty four, twenty six, twenty nine, and thirty represent a logic high state while the remaining bits are a logic low state. The binary representation 401 of the marked data can be expressed as a decimal number "848,560,128". Therefore figure 3 depicts a milk crate 100 with a serial number of "848,560,128".

Figure 5 is a close-up illustration of the gusset area 101 of figure 3. It is clearly visible that the barcode pattern 300 of figure 5 matches the barcode layout 200 of figure 4.

Figure 6 is a perspective view further illustrating the gusset area 101 of figure 3. Figure 6 illustrates the method of producing visible contrast between the plastic of the crate 100 and the drill holes 400 of the barcode 300. A light source 600 shines light rays 601 onto the outside surface of said crate 100. The light rays 601 that strike the plastic surface are

reflected into a lens 603 of an optical barcode reader 602. Rays of light 601 from said light source 600 that strike the drilled holes of said barcode 300 are not reflected into the lens 603. Thus an optical pattern is created by means of contrasting reflected light 601 from the surface of said crate 100.

The flowchart of figure 7 demonstrates the process of creating new barcodes 300 on unmarked crates 100 and the recovery of serial numbers from barcode marked crates 703 destined for disposal 705. Each crate 100 requires a unique barcode 300 in order to be identified uniquely. Therefore a serialized barcode 300 can only exist once in the group of crates in active circulation. A serial number database 709 is used to store information pertaining to the use of the serial number. If an unused serial number is requested by the CNC drilling machine 701 from said database 709 then permission is given to use the serial number and said serial number database 709 is altered to indicate that said serial number is in use and is not available for reuse as indicated by step 710. Upon receiving a usable serial number 710 the coupled CNC drilling machine can mark said crate 100 as indicated in step 702.

When crates 100 are no longer usable they are discarded. In order to limit the use of new serial numbers a method is provided in figure 7 for recovering serial numbers from crates destined for disposal 705 and allow the serial numbers to be reused on unmarked crates. A coupled optical barcode reader 602 records serial numbers 704 of crates destined for disposal. The serial number database 709 is altered to reflect availability of the serial number 706. The scanned crate 707 is then destroyed 708.

Figure 8 is a flowchart illustrating a method for tracking a milk crate within the manufacturing process and using data from said tracking to affect business management. An optical barcode reader 602 is affix in proximity to passing crates on a conveyor 801. Said optical barcode reader being able to read said crates, captures unique identifier data 802 and creates records 806 of said data in a coupled computerized database 805. Additionally, the location of said optical barcode reader is known therefore positional and process data 808 can also be associated in said database to said unique identifier. A further process of management compiling reports 809 from said data can be utilized to influence operational management decisions 810.

Figure 9 is a flowchart illustrating a method for identifying the contents of a milk crate by means of tracking. Additionally, using content data and tracking data of the crate to manage inventory levels of different business units within the firm. An optical barcode reader 602 is affix in proximity to passing crates exiting a packing machine. Said optical barcode reader being able to read said crates, captures unique identifier data 902 and creates records 907 of said data in a coupled computerized database 908. Additionally, said packaging machine is coupled to computerized database 908 and settings data recorded 906 in said database 908. An association in said computerized database 908 is established between the unique identity of said crate exiting the packing machine 907 and settings of said packing machine indicating product and pack quantity 906. Therefore the data captured from the packing machine and the crate identification data captured from the exit of the packing machine, by means of optical barcode reader 602, creates a direct correlation between a specific crate and the contents therein. Furthermore, successive optical barcode readers 904 elsewhere in the factory can identify said crate and record time, crate identity, and positional

data 909 to a coupled computerized database 908. A query 910 of said databases 908 by crate identity would produce a correlation of product, determined by crate content, and location determined by crate tracking. Thusly the flow of product is tracked from one business unit to another within the manufacturing environment 910.

Figure 10 is a flowchart illustrating a method for tracking inventory levels of a specific storage location. The method comprises the process of affixing an optical barcode reader 602 in proximity of all entrances 1002 and exits 1014 of said storage location. Each optical barcode reader being able to read said crates, capture unique identifier data and create records of said data in a coupled computerized database 1007. Additionally, said database coupled to the packing machine and optical barcode reader 602 in proximity of packing machine exit as disclosed in the process flowchart of figure 9 to produce crate content data 1009. Said content data 1009 used to identify product and quantity thereof based on crate identity as disclosed in steps 1105 and 1011. Consequently a relation exist between the unique identity of the entering and exiting milk crates and the content thereof, thusly a query 1008 to said coupled database1007 requesting the difference of the sum of product entering 1004 the storage area and the sum of product leaving 1010 the storage area describes the inventory level of said storage area.

Figure 11 is a flowchart illustrating a method for tracking a specific crate of product to a customer. The method comprises the process of affixing an optical barcode reader 602 in proximity to an in-feed conveyor 1105 of an order fulfillment workstation. Said optical barcode reader being able to read said crates 1105, capture unique identifier data 1109 and create records 1110 of said data in a coupled computerized database1106. Additionally, customer order data is also recorded 1101 in said database 1106 with an association to crate

identifications used to fulfill said order. In the event management would like to recall the final destination of a specific crate 1103, a query 1102 to the said database 1106 with the crate identity would produce the recipient data sought 1111.

Although a few preferred embodiments have been shown and described, it will be appreciated by those skilled in the art that various changes and modifications might be made without departing from the scope of the invention. It is known by those skilled in the art that alternate names and devices exist that could be used in place of an optical barcode reader 602 and produce equivalent results and meaning such as vision sensor, smart camera, vision system, machine vision, optical scanner, barcode scanner, scanner, and barcode sensor. It is known by those skilled in the art that alternate names exist that could be used in place of two-dimensional barcode and produce equivalent meaning such as barcode, unique identifier, identifying code, unique indicia, identifying mark, unique mark, machine readable code, optical pattern, optically encoded pattern, dot code, optical code, and visible pattern. The terms and expressions used in the preceding specification have been used herein as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding equivalents of the features shown and described or portions thereof, it being recognized at the scope of the invention as defined and limited only by the claims that follow.

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. The method of uniquely marking plastic reusable milk crates and tracking said crates comprising the steps of:
   a) Drilling a unique two-dimensional barcode pattern through a plurality of side walls of the said milk crate;
   b) Reading said barcode on the milk crate by means of an optical barcode reader;
   c) Assigning read barcode data to a coupled computerized database.
2. The method as set forth in claim 1 further comprising the step of assigning production line process data to said coupled computerized database.
3. The method as set forth in claims 1 further comprising the step of reading said database and using read data to affect production line control.
4. The method as set forth in claims 2 further comprising the step of reading said database and using read data to affect production line control.
5. The method as set forth in claim 1 further comprising the step of reading said database and using read data to affect manufacturing operations management.
6. The method as set forth in claim 2 further comprising the step of reading said database and using read data to affect manufacturing operations management.
7. The method of drilling a two-dimensional barcode into the sidewall of a plastic reusable milk crate by means of a computer numeric control wherein the computer numeric controlled material removal machine is governed by barcode serial number availability from a coupled computerized database.

8. The method as set forth in claim 7 wherein the availability of a specific barcode serial number is automatically restricted in said coupled computerized database after the drilling machine has successfully completed the drilling of said barcode.

9. The method as set forth in claim 7 wherein the availability of a specific barcode serial number is automatically unrestricted in said coupled computerized database after the said serial number is reclaimed from a crate removed from active circulation.

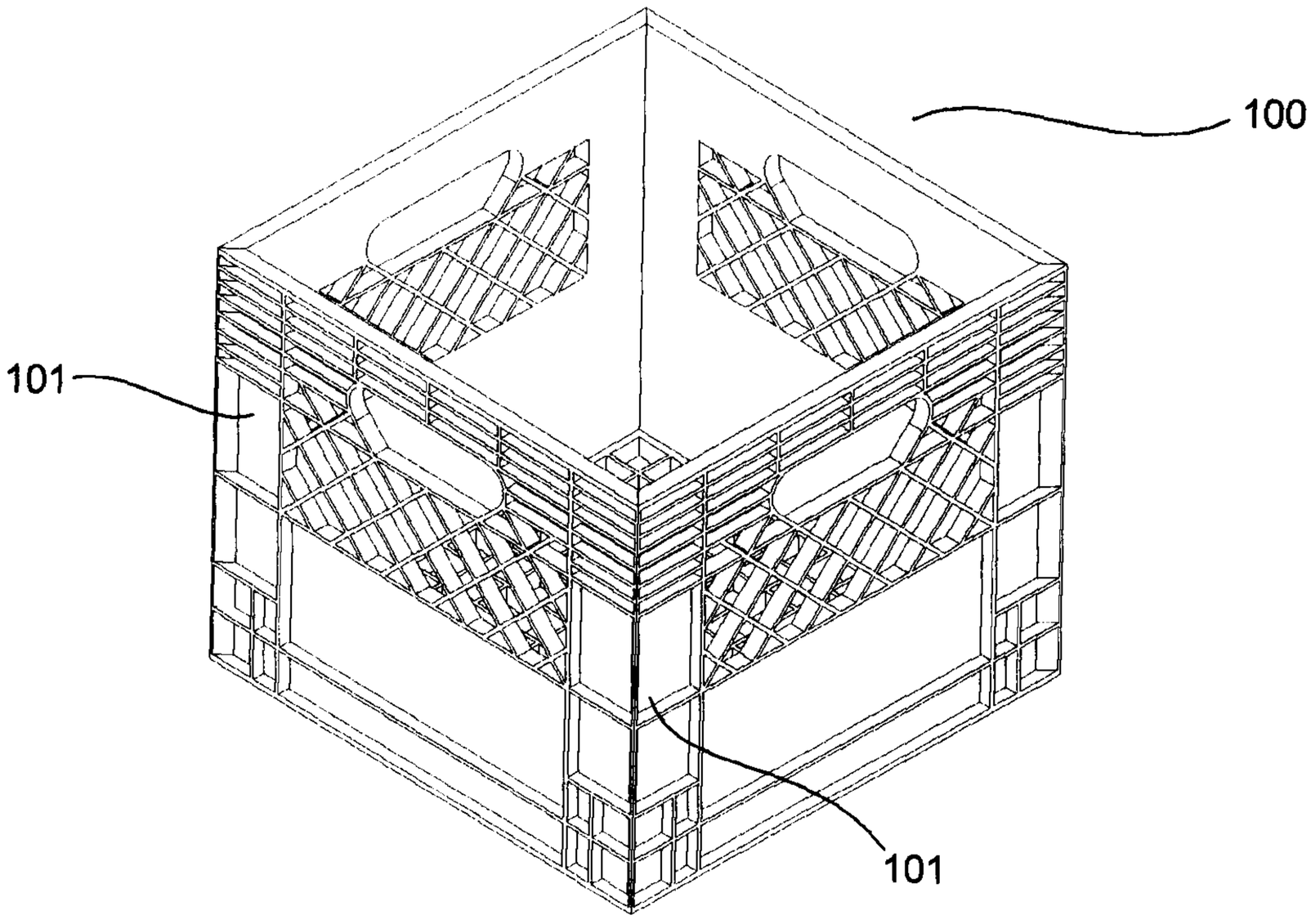


Figure 1

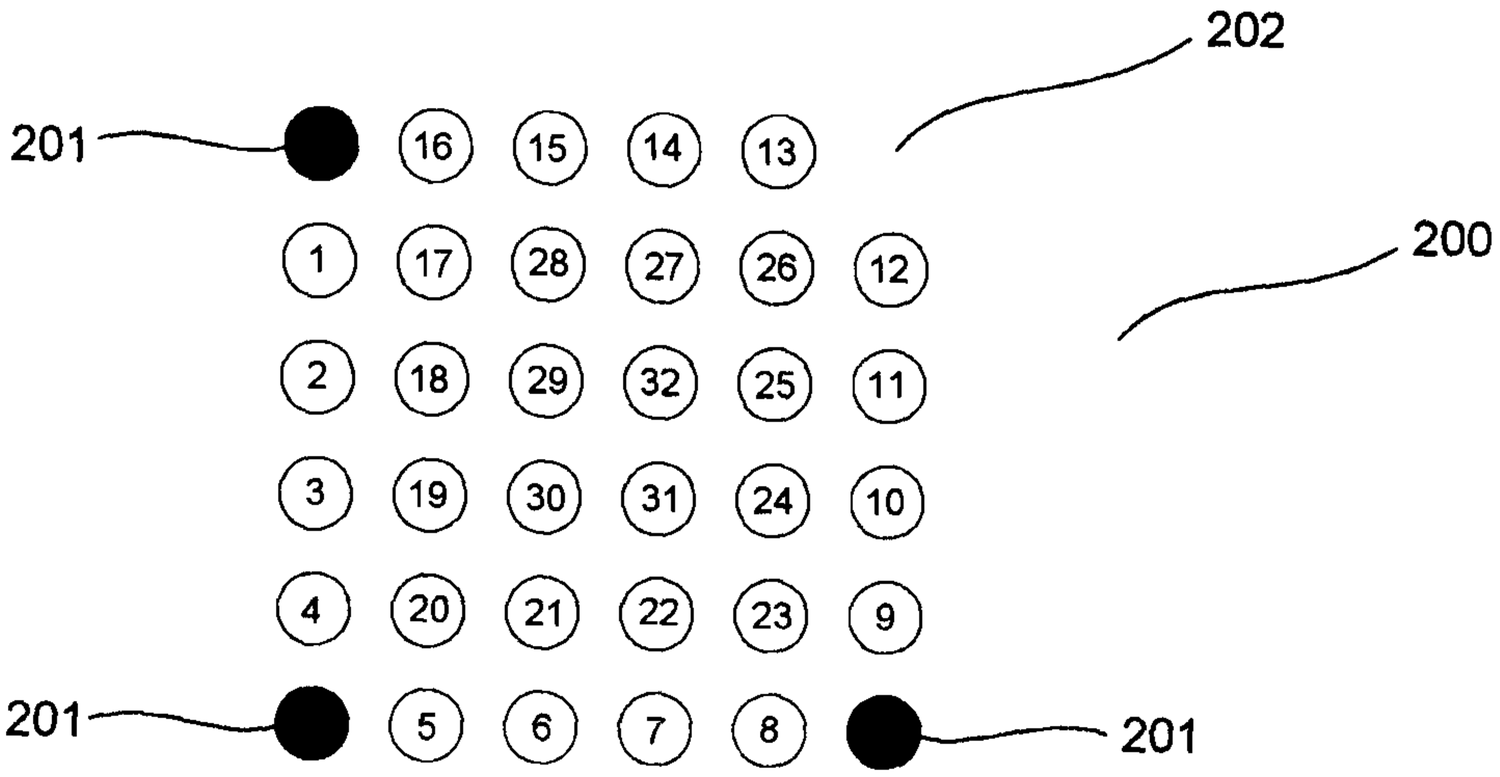


Figure 2

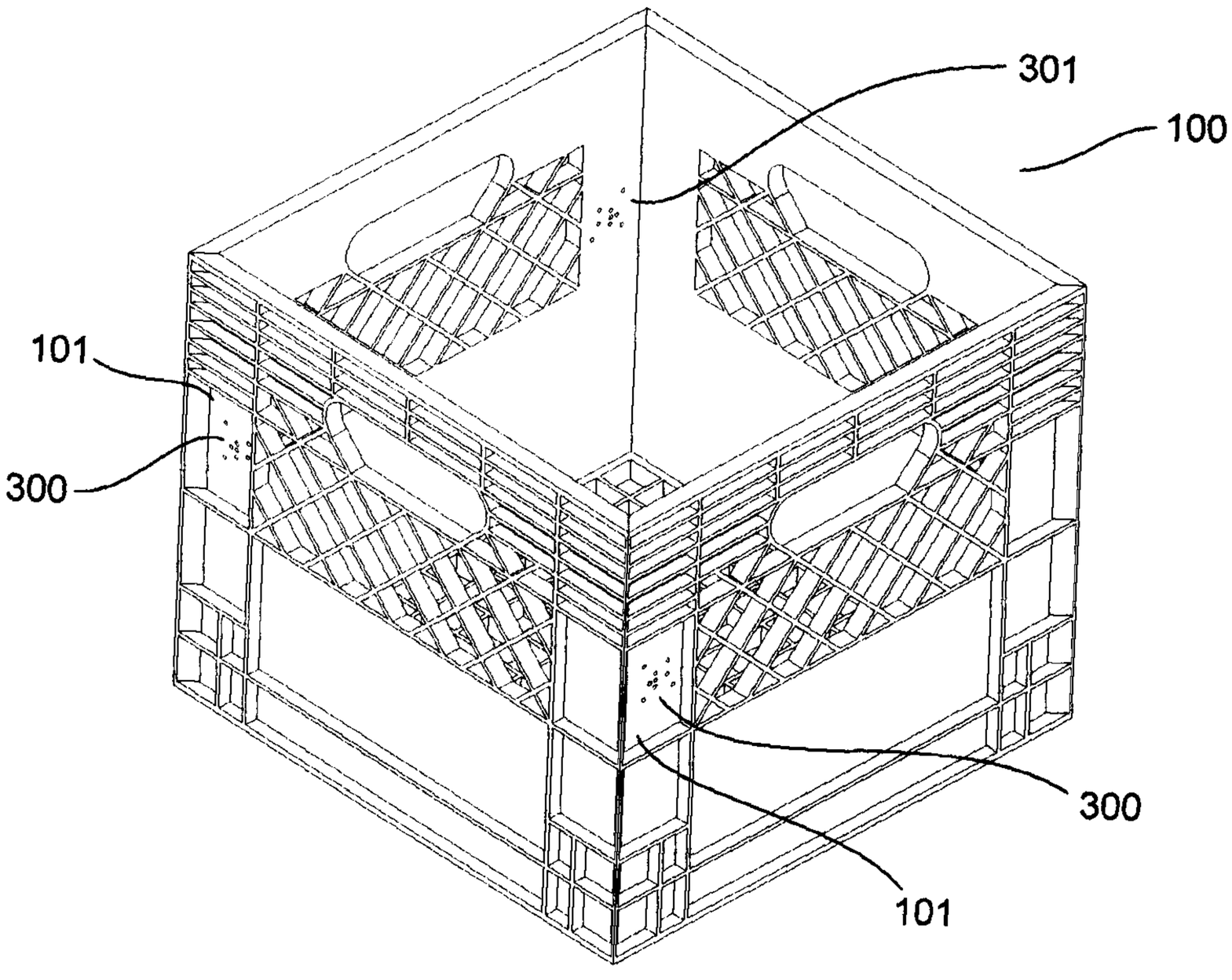


Figure 3

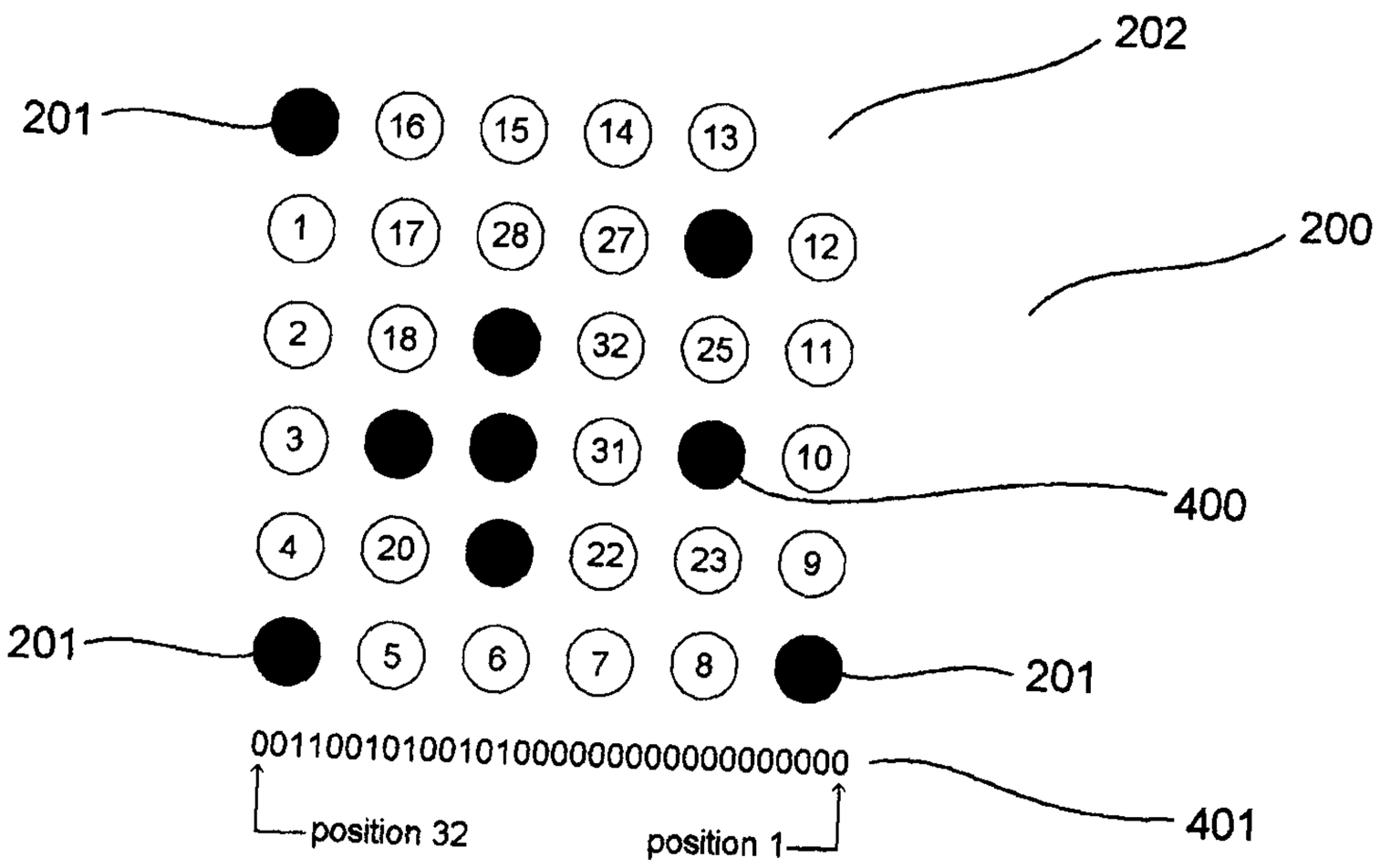


Figure 4

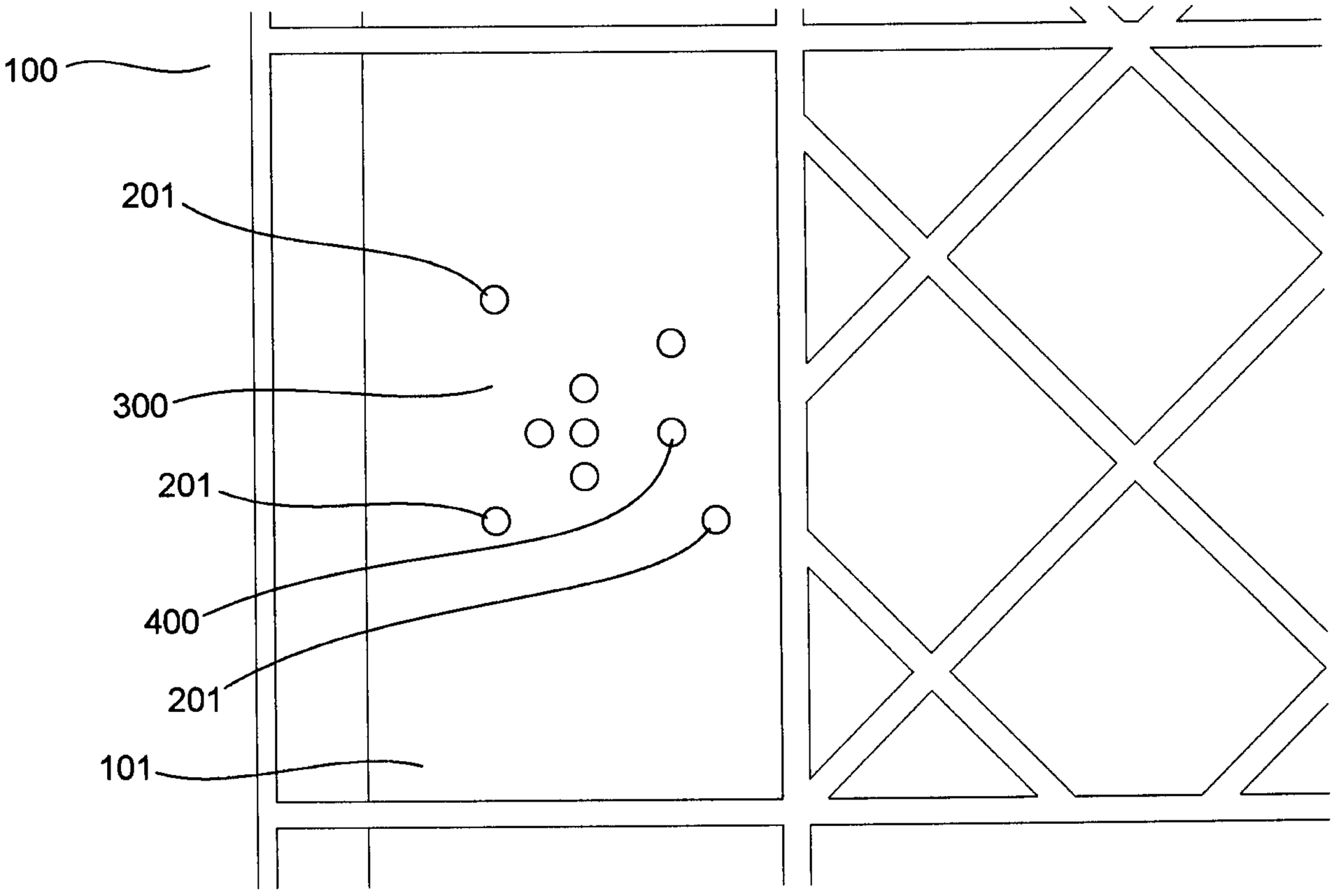


Figure 5

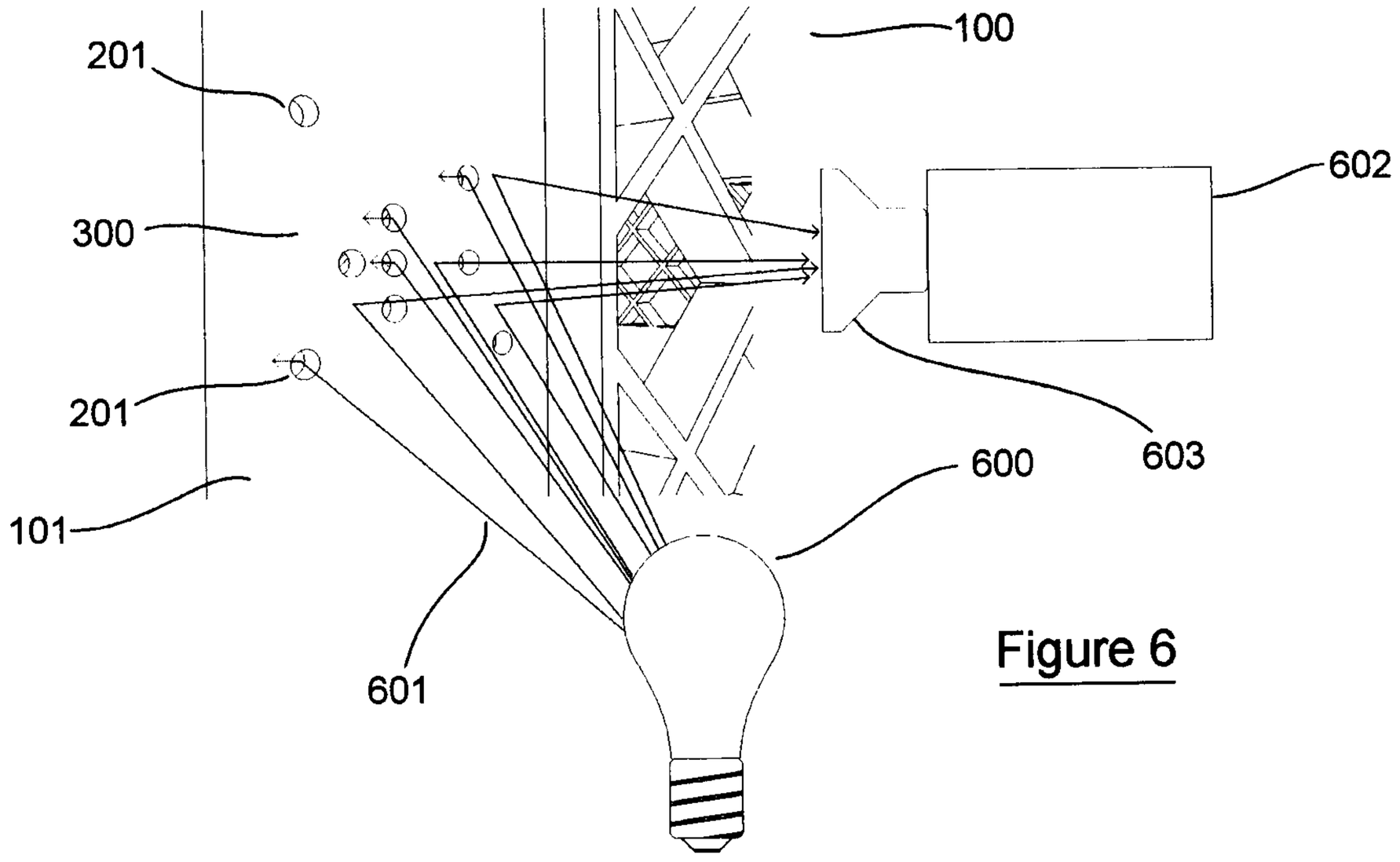


Figure 6

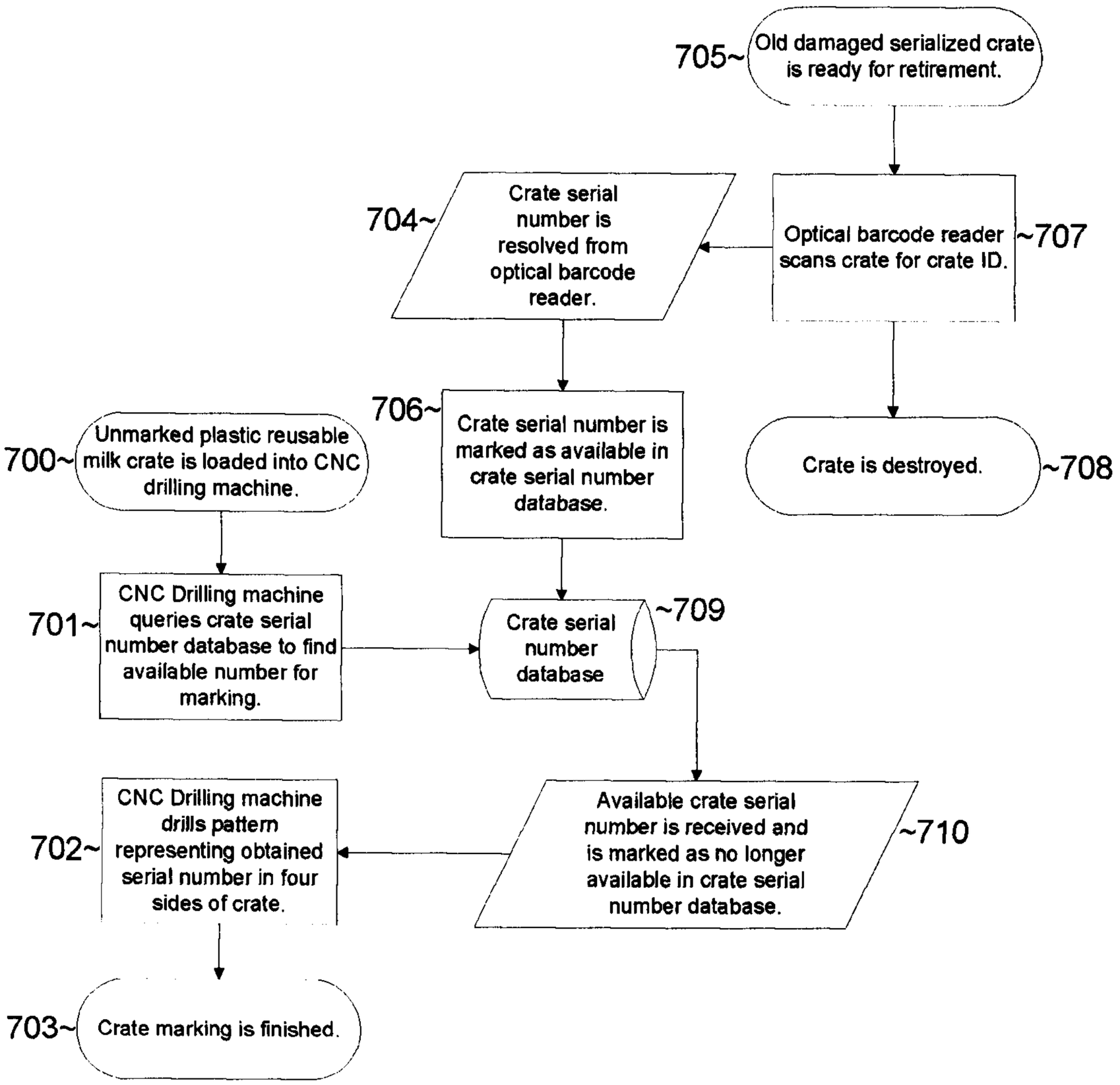

705~
Old damaged serialized crate is ready for retirement.
704~
Crate serial number is resolved from optical barcode reader.
Optical barcode reader scans crate for crate ID.
~707
706~
Crate serial number is marked as available in crate serial number database.
700~
Unmarked plastic reusable milk crate is loaded into CNC drilling machine.
Crate is destroyed.
~708
701~
CNC Drilling machine queries crate serial number database to find available number for marking.
Crate serial number database
~709
CNC Drilling machine drills pattern representing obtained serial number in four sides of crate.
Available crate serial number is received and is marked as no longer available in crate serial number database.
~710
702~
703~
Crate marking is finished.

Figure 7

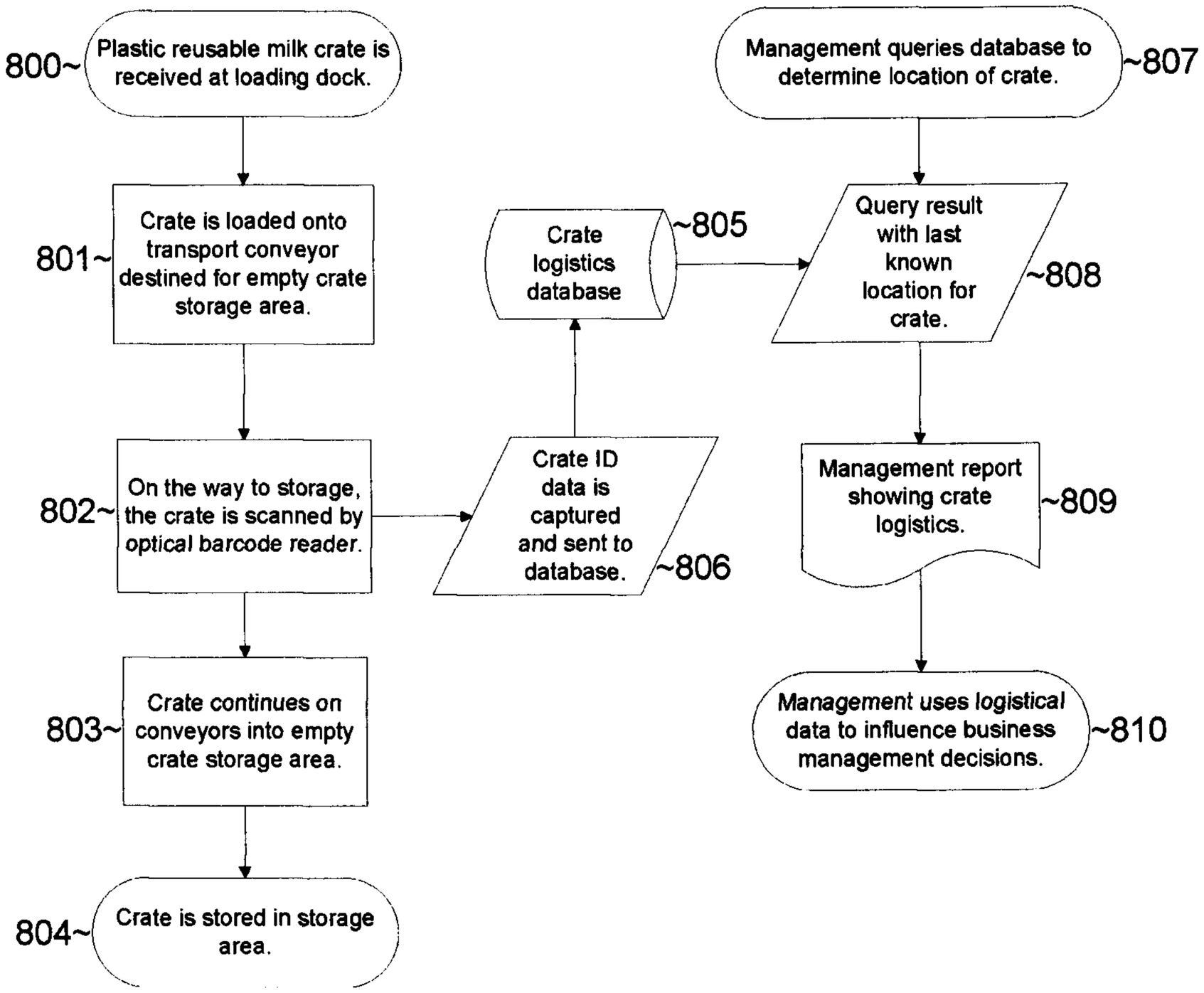

800~
Plastic reusable milk crate is received at loading dock.
801~
Crate is loaded onto transport conveyor destined for empty crate storage area.
802~
On the way to storage, the crate is scanned by optical barcode reader.
803~
Crate continues on conveyors into empty crate storage area.
804~
Crate is stored in storage area.
Crate ID data is captured and sent to database.
~806
Crate logistics database
~805
Management queries database to determine location of crate.
~807
Query result with last known location for crate.
~808
Management report showing crate logistics.
~809
Management uses logistical data to influence business management decisions.
~810

Figure 8

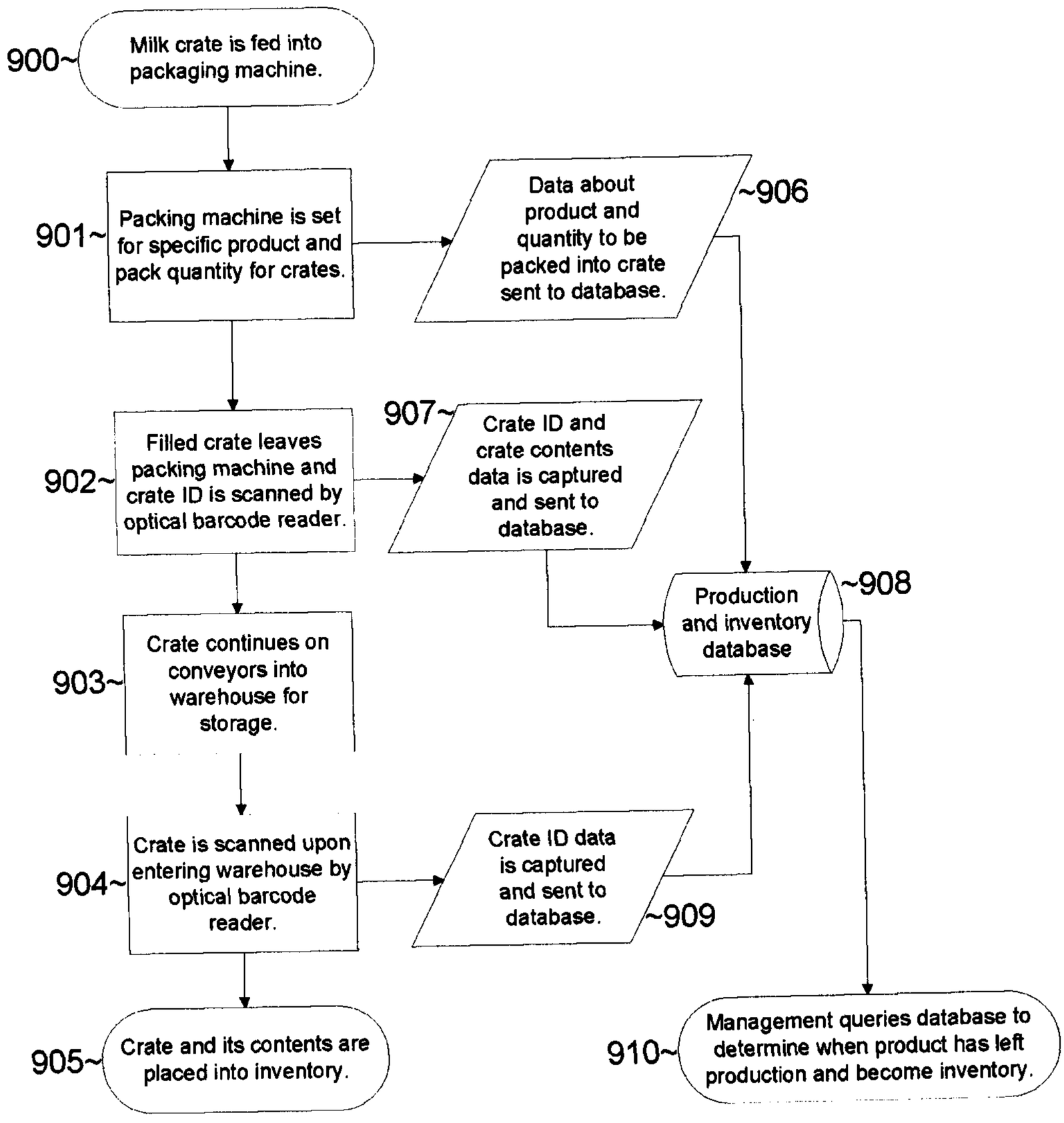

900~
Milk crate is fed into packaging machine.
901~
Packing machine is set for specific product and pack quantity for crates.
~906
Data about product and quantity to be packed into crate sent to database.
902~
Filled crate leaves packing machine and crate ID is scanned by optical barcode reader.
907~
Crate ID and crate contents data is captured and sent to database.
~908
Production and inventory database
903~
Crate continues on conveyors into warehouse for storage.
904~
Crate is scanned upon entering warehouse by optical barcode reader.
Crate ID data is captured and sent to database.
~909
905~
Crate and its contents are placed into inventory.
910~
Management queries database to determine when product has left production and become inventory.

Figure 9

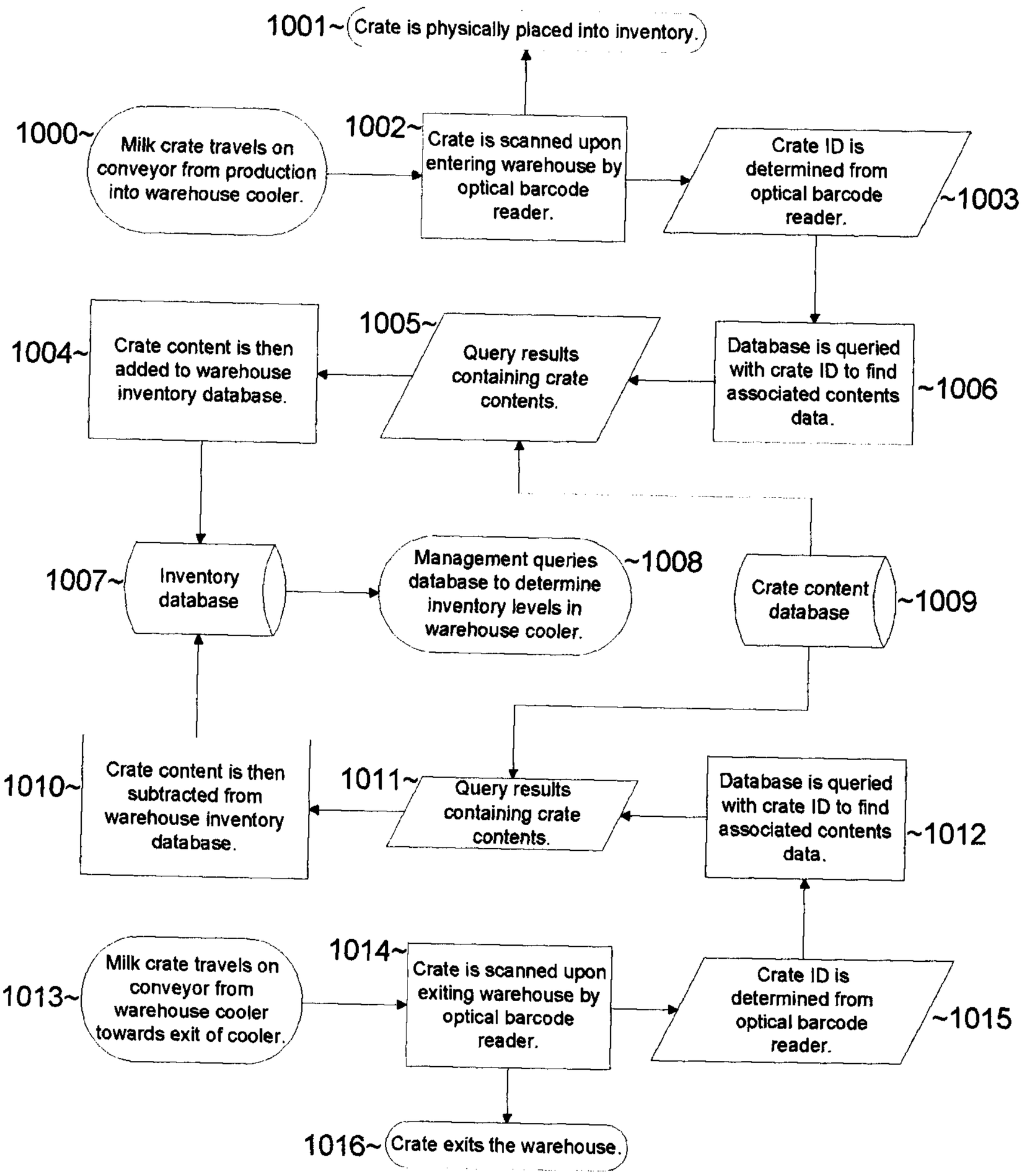

1001~ Crate is physically placed into inventory.
1000~ Milk crate travels on conveyor from production into warehouse cooler.
1002~ Crate is scanned upon entering warehouse by optical barcode reader.
Crate ID is determined from optical barcode reader.
~1003
1004~ Crate content is then added to warehouse inventory database.
1005~ Query results containing crate contents.
Database is queried with crate ID to find associated contents data.
~1006
1007~ Inventory database
Management queries database to determine inventory levels in warehouse cooler.
~1008
Crate content database
~1009
1010~ Crate content is then subtracted from warehouse inventory database.
1011~ Query results containing crate contents.
Database is queried with crate ID to find associated contents data.
~1012
1013~ Milk crate travels on conveyor from warehouse cooler towards exit of cooler.
1014~ Crate is scanned upon exiting warehouse by optical barcode reader.
Crate ID is determined from optical barcode reader.
~1015
1016~ Crate exits the warehouse.

Figure 10

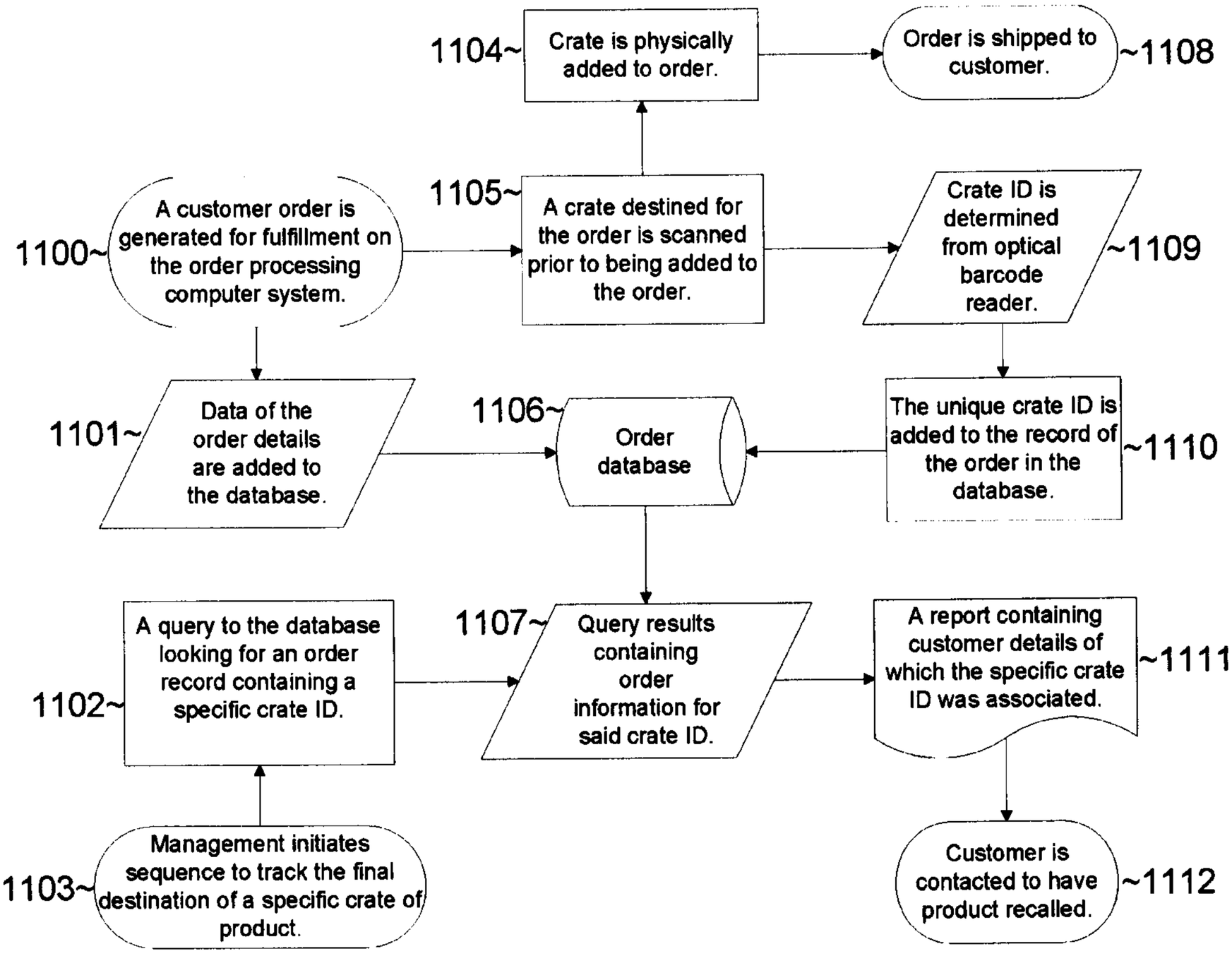
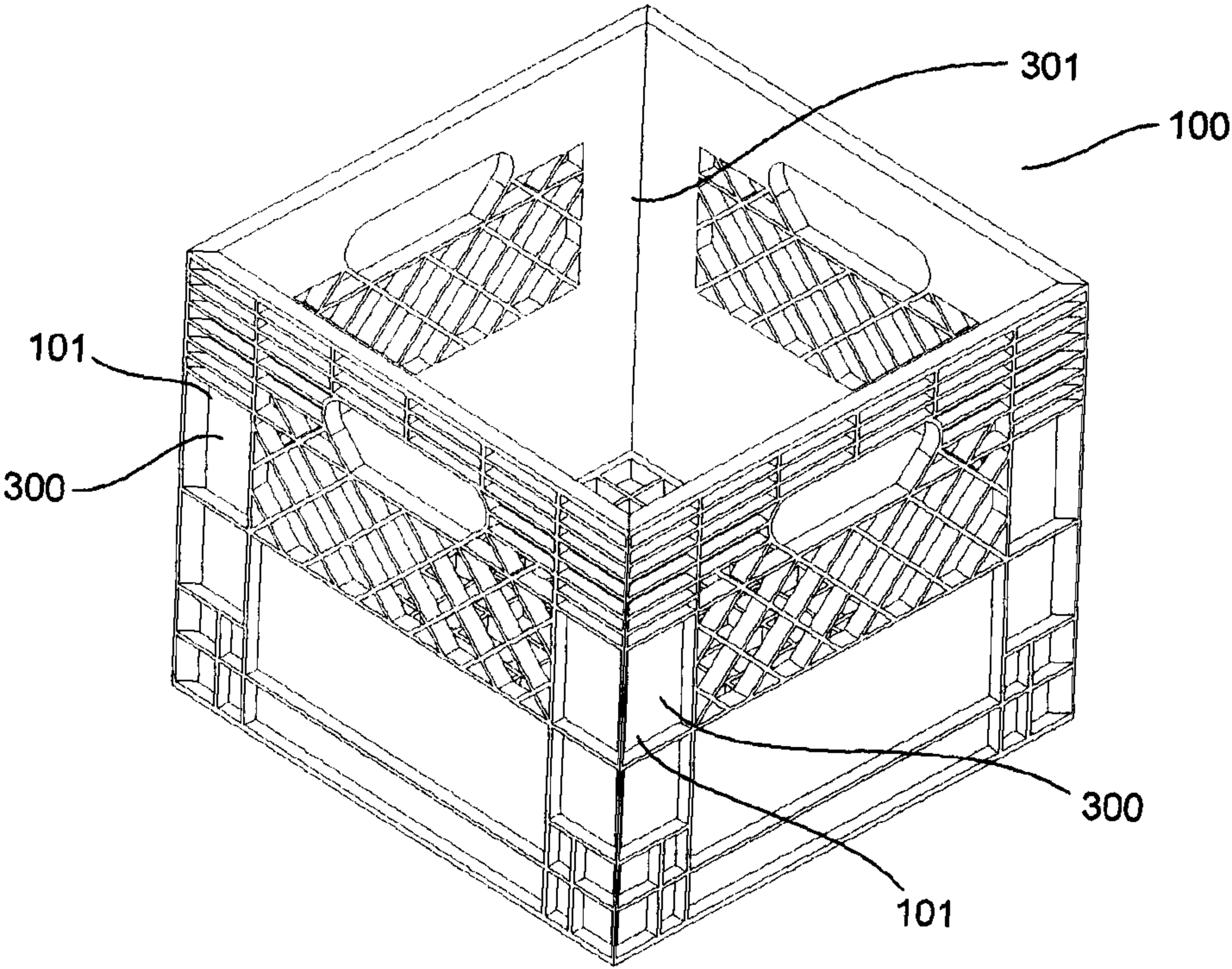

1104~
Crate is physically added to order.
Order is shipped to customer.
~1108
1105~
A crate destined for the order is scanned prior to being added to the order.
Crate ID is determined from optical barcode reader.
~1109
1100~
A customer order is generated for fulfillment on the order processing computer system.
1101~
Data of the order details are added to the database.
1106~
Order database
The unique crate ID is added to the record of the order in the database.
~1110
1107~
Query results containing order information for said crate ID.
A report containing customer details of which the specific crate ID was associated.
~1111
1102~
A query to the database looking for an order record containing a specific crate ID.
1103~
Management initiates sequence to track the final destination of a specific crate of product.
Customer is contacted to have product recalled.
~1112

Figure 11


301
100
101
300
300
101