



(51) International Patent Classification:
G05B 19/418 (2006.01)

(21) International Application Number:
PCT/EP2011/055478

(22) International Filing Date:
8 April 2011 (08.04.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1000366-3 12 April 2010 (12.04.2010) SE

(71) Applicant (for all designated States except US): **TETRA LAVAL HOLDINGS & FINANCE S.A.** [CH/CH]; Av. Général-Guisan 70, CH-1009 Pully (CH).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **LARSSON, Mikael** [SE/SE]; Holmby 2901, S-24797 Flyinge (SE). **BERG, Karin** [SE/SE]; Granstigen 7, S-24772 Genarp (SE).

(74) Agent: **FREDRIKSSON, Anders**; AB Tetra Pak, Patentavdelningen, Ruben Rausingsgata, S-22186 Lund (SE).

(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, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: A MONITORING SYSTEM FOR A PACKAGING SYSTEM WITH BATCH EQUIPMENT

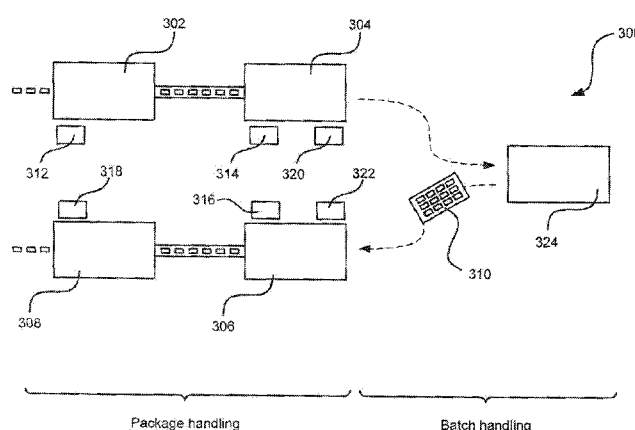


Fig 3

(57) Abstract: A monitoring system for a packaging system comprising batch equipment is presented. The monitoring system comprises a rack load sensor for determining a number of packages loaded onto a rack, a first identification tag reader for determining an identity of the rack by reading an identification tag provided on the rack in a batch processing start position, a second identification tag reader for determining the identity of the rack by reading the identification tag provided on the rack in a batch processing end position, a rack unload sensor for determining a number of packages unloaded from the rack, and a processing apparatus configured to determine that said rack in said batch processing start position is the same as the rack in the batch processing end position, and to determine a number of wasted packages by comparing number of packages loaded onto the rack and the number of packages unloaded from the rack.

A monitoring system for a packaging system with batch equipment

Technical Field

The invention generally relates to the field of packaging technology. More particularly, the invention relates to a monitoring system for a food
5 packaging system comprising single package handling equipment as well as batch handling equipment.

Background of the invention

Today, it is increasingly popular to pack food in carton-based
10 packages. Apart from being cost-efficient in terms of material costs as well as transportation costs this type of packages has the advantage of being made of renewable material, which makes it a good alternative for the environment. An example of such type of package is Tetra Recart™ provided by Tetra Pak.

Packaging systems, carton-based systems as well as other, often have
15 monitoring functionality, most often in the form of sensors for collecting information connected to a computer for processing the collected information. A measure common to determine is a so-called efficiency measure indicating the relationship between the output and the input, in other words the relationship between produced packages and input package blanks.

20 A number of sources of error may affect the efficiency measure. For instance, packages are from time to time taken out of the process line by an operator for inspection, during break down packages are wasted, etc.

For companies packing products the efficiency measure is of great importance, and therefore there is a need that this parameter is determined
25 as accurately as possible.

Summary

An object is to overcome or alleviate the above-described problems. More particularly, the problem to be solved is how to achieve an accurate

monitoring system for a packaging system in which part of the steps are performed in machine units handling packages one by one and part of the steps are performed in machine units handling packages in batches.

Generally, in order to keep track of the packages when being handled in batches, racks used for holding batches of packages are provided with identification tags. Thus, by registering the identification of the rack when the rack is leaving the packaging line, in which the packages are handled package by package, and by registering the identification once again the rack returns to the packaging line the packages can be followed even when these are not in the packaging line. Further, by counting the packages when loading them onto the rack and by counting the package when unloading them from the rack, it is possible to determine packages wasted during the time outside the packaging line.

Further, when having determined the number of wasted packages, an efficiency measure for the packaging system may be determined by dividing the number of output packages with the sum of the number of wasted packages and the number of output packages. This efficiency measure is more accurate than an efficiency measure determined by dividing the number of output packages with the number of input packages, which is the common approach to determine the efficiency measure.

If a large number of packages may be situated between the two sensors used for detecting packages and, in turn, for determining the number of wasted packages, the monitoring system may be configured to determine the number of wasted packages when no packages are present between the two sensors. In this way, since only packages passing both of the two sensors, or more correctly, packages passing both the sensors or packages that should have passed both the sensors if they were not wasted between the sensors, are taken into account.

By knowing the speed of the packaging system between the two sensors the monitoring system can determine when no packages are present between the two sensors.

According to a first aspect a monitoring system for a packaging system comprising batch equipment is provided. The packaging system comprises a

packaging line. The monitoring system comprises a rack load sensor for determining a number of packages loaded onto a rack in a rack load position of said packaging line, a first identification tag reader for determining an identity for said rack by reading an identification tag provided on said rack in a
5 batch processing start position of said packaging line, a second identification tag reader for determining said identity of said rack by reading said identification tag provided on said rack in a batch processing end position of said packaging line, a rack unload sensor for determining a number of packages unloaded from said rack in a rack unload position of said packaging
10 line, and a processing apparatus configured to determine that said rack in said batch processing start position is the same as said rack in the batch processing end position by comparing said identity determined in said batch processing start position with said identity determined in said batch processing end position, and to determine a number of wasted packages in a
15 packaging system with batch equipment by comparing said number of packages loaded onto said rack and said number of packages unloaded from said rack.

The monitoring system may further comprise a first sensor for determining a number of packages passing a first position of said packaging
20 line, a second sensor for determining a number of packages passing a second position of said packaging line, said first and second position being placed upstream said rack load position, said processing apparatus being further configured to determine a number of wasted packages between said first position and said second position of said packaging line.

25 The monitoring system may further comprise a third sensor for determining a number of packages passing a third position of said packaging line, a fourth sensor for determining a number of packages passing a fourth position of said packaging line, said third and fourth sensor being placed downstream said rack unload position, said processing apparatus being
30 further configured to determine a number of wasted packages between said third position and said fourth position of said packaging line.

The monitoring system may further comprise an output sensor for determining number of packages output from said packaging system, said

processing apparatus being further configured to determine a total number of wasted packages for said packaging system, to determine a number of input packages by adding said number of output packages and said total number of wasted packages, and to determine an efficiency measure by dividing said
5 number of output packages with said number of input packages.

The identification tag provided on said rack may be an RFID tag.

The RFID tag may be encapsulated in order to withstand retorting.

The sensors may be photocells.

The rack load position may coincide with said batch processing start
10 position.

The rack unload position may coincide with said batch processing end position.

The processing apparatus may further be configured to start a timer when said rack is identified in said batch processing start position, and if said
15 timer elapse before said rack is identified in said batch processing end position determine that said number of packages determined by said rack load sensor is wasted packages.

According to a second aspect a method for determining a number of wasted packages in a packaging system with batch equipment is provided.
20 The packaging system may comprise a packaging line. The method may comprise determining a number of packages loaded onto a rack in a rack load position of said packaging line, determining an identity for said rack by reading an identification tag provided on said rack in a batch processing start position of said packaging line, determining said identity of said rack by
25 reading said identification tag provided on said rack in a batch processing end position, determining that said rack in said batch processing start position is the same as said rack in the batch processing end position by comparing said identity determined in said batch processing start position with said identity determined in said batch processing end position, determining a number of
30 packages unloaded from said rack in a rack unload position of said packaging line, and determining said number of wasted packages in a packaging system with batch equipment by comparing said number of packages loaded onto said rack and said number of packages unloaded from said rack.

The method may further comprise starting a timer when said rack is identified in said batch processing start position, and if said timer elapse before said rack is identified in said batch processing end position, determining that said number of packages determined by said rack load sensor is wasted packages.

According to a third aspect a method for determining a number of wasted packages for a packaging system is provided. The packaging system may comprise a packaging line. The method may comprise determining a first number of wasted packages between a first position and a second position of said packaging line by determining a number of packages passing said first position and a number of packages passing said second position, determining a second number of wasted packages according to the second aspect, and determining said number of wasted packages by adding said first and said second number of wasted packages.

The method may further comprise determining a third number of wasted packages between a third position and a fourth position of said packaging line by determining a number of packages passing said third position and a number of packages passing said fourth position, wherein said step of determining said number of wasted packages further comprises adding said third number of wasted packages to said first and said second number of wasted packages.

According to a fourth aspect a method for determining an efficiency measure in a packaging system is provided. The method may comprise determining a number of output packages from said packaging system, determining a number of wasted packages according to the second or third aspect, determining a number of input packages by adding said number of output packages and said number of wasted packages, and determining an efficiency measure by dividing said number of output packages with said number of input packages.

According to a fifth aspect it is provided a computer program comprising computer program code adapted to perform any one of the methods of second, third or fourth aspect when said program code is executed on a computer.

The computer program may be embodied on a computer readable medium.

As described above, a number of the plurality of machine units may be provided with sensors. This should be understood as that some or all of the machine units may be provided with sensors. For instance, the machine units generating a lot of waste or holding many packages may be provided sensors.

The wording processing apparatus should be interpreted broadly. It can be one single piece of hardware or a distributed system comprising a number of pieces of hardware. More particularly, the processing apparatus may comprise a machine unit processing device for one or several machine units and a monitoring system processing device connected to the machine unit processing devices.

Further, the processing apparatus, or the machine unit processing devices, can be configured to interpret the output from the sensors, e.g. determine if a package is present or not based on a signal, or alternatively the sensors themselves may comprise functionality for interpreting the signal.

The wording communications network should also be interpreted broadly. Information may be sent via wire or wireless via e.g. Wi-Fi, UMTS. Further, the information may be sent direct from, for instance, the machine units to the monitoring system processing device, or indirect via other computers.

Further, several monitoring system processing devices may exist. For instance, one monitoring system processing device may be placed on site and another monitoring system processing device may be placed at the service provider, thereby making it possible for the service provider to remotely support the packaging system. Additionally, if having several monitoring system processing devices, these may be arranged such that wasted packages, efficiency measure etc are determined in one of the monitoring processing system devices and then distributed to the other.

Brief description of the drawings

The above, as well as additional objects, features and advantages of the present invention, will be better understood through the following illustrative and non-limiting detailed description of preferred embodiments of the present invention, with reference to the appended drawings, wherein:

Fig 1 illustrates a general overview of a packaging system.

Fig 2 illustrates an accumulator unit provided with a machine input sensor, a machine output sensor and a machine unit processing device.

Fig 3 generally illustrates a packaging system comprising a single package handling section and a batch handling section.

Fig 4 presents a flowchart illustrating a method for determining wasted packages in a packaging system comprising batch equipment.

Fig 5 presents a flowchart illustrating a method for determining an efficiency measure for a packaging system comprising batch equipment.

Detailed description of preferred embodiments

Fig 1 illustrates an example of a carton-based packaging system 100 for food comprising a plurality of machine units provided with sensors, such as photocells, for detecting packages input and packages output. In this example the sensors are divided into default sensors, i.e. sensors required in this example, depicted with solid line circles, and optional sensors, herein depicted with dashed line circles.

The process line starts with a forming and sealing unit 102. Packages, in the form of blanks with pre-made longitudinal sealings, are fed from an infeed 104. After being fed into the forming and sealing unit 102 the packages are erected into sleeves. In order to keep track of packages fed into the forming and sealing unit 102, the infeed 104 may optionally be provided with a machine input sensor. After having erected the packages, bottoms are formed and sealed. The packages leave the forming and sealing 102 with an open top end. In order to detect a number of packages output from the forming and sealing unit 102 an output sensor may optionally be placed at an outfeed.

Via a conveyor, the packages are transported into a filling unit 106 arranged to fill the packages with food via the open top end. In order to determine the number of packages wasted in this machine unit an input sensor and an output sensor may be used. One reason for wasting a package
5 in the filling unit may be that packages are overfilled.

After having been filled with food product the packages can optionally be conveyed to a level check unit 108. The level check unit 108 may be provided with an input sensor and an output sensor in order to determine a number of wasted packages in the machine unit. One reason for wasting
10 packages in the level check unit may be because the filling level of the packages is incorrect, thereby making it hard, or even impossible, to make adequate top sealings.

Next step, in this particular example, the packages are conveyed into the forming and sealing unit 102 once again. This time the open ends of the
15 packages are sealed and top portions of the packages are formed, e.g. by folding down the sealing end in order to form a flat top and to fold down the outer flaps of the sealing end towards the side sections of the packages. In this way brick shaped packages are formed. As illustrated, sensors may be placed at the input as well as the output of the forming and sealing unit 102 in
20 order to measure a number of wasted packages during top sealing and top forming. One reason for wasting packages during these procedures may be because of insufficient top sealing.

The sealed and formed packages can thereafter be conveyed to an accumulator unit 110. The reason for having the accumulator unit 110 is to
25 store packages. In other words, when having the accumulator unit 110, the forming and sealing unit 102, the filling unit 104 and the level check unit 106 may continue to run even if a breakdown has occurred downstreams in the packaging line, since the packages may be stored in the accumulator unit 110. As the other machine units, the accumulator unit 110 may be provided
30 with an input sensor and an output sensor. One reason for wasting packages in the accumulator unit 110 can be that when the accumulator unit 110 is full packages are wasted. In this example only one accumulator unit 110 is

present, but in order to make it possible to store more packages several accumulator units placed after each other may be used.

Next, the packages are conveyed to a handling system input station 112. In this station a number of packages are loaded onto racks. The racks
5 are in a next step placed in a retorting device 114 for being retorted. By retorting the packages and the content of the packages the due date may be extended to 24 months. After having been retorted the packages are put into the packaging line again via a handling system output station 116.

The handling system may be automatic, manual or semi-automatic,
10 that is, having some of the steps being performed automatically, such as loading the trays, and some of the steps being performed manually, such as loading the trays into the retorting devices.

The handling system input station 112 may be provided with an input sensor and the handling system output station 116 may be provided with an
15 output sensor. In this way, the number of wasted packages in the handling system may be measured.

Next, in this example, the packages are conveyed to secondary packaging units 118a, 118b. In this example, the system is designed such that the line of packages are divided into two parallel packaging lines, thereby
20 making it possible to use two secondary packaging units 118a, 118b simultaneously.

The secondary packaging units 118a, 118b can be arranged to gather a number of packages and to place these in a secondary package, such as a carton board tray. Input sensors and an output sensors may be used to
25 determine a number of wasted packages in these units.

As the last step of this packaging system, the secondary packages can be conveyed to film wrapping units 120a, 120b. In these units, the secondary packages from the secondary packaging units 118a, 118b are wrapped in plastic film. Input sensors and an output sensors may be used to determine a
30 number of wasted secondary packages in these units, and thereby implicitly the number of packages wasted since the number of packages per secondary package is known.

Although not illustrated, the secondary packages wrapped in plastic film may be conveyed to a palletizer unit which load the secondary packages onto a pallet. Also in this unit an input sensor and an output sensor may be used to determine the number of wasted secondary packages.

5 As illustrated, in this example, the input sensor and output sensor for the accumulator unit 110 and the output sensors from two parallel film wrappers 120a, 120b are set as default. The accumulator unit 110 is chosen as default because packages may be wasted in the accumulator unit if the accumulator unit is full, which may arise when breakdown has occurred after
10 the accumulator unit and the process line before the accumulator unit 110 is still running. Thus, since it is likely that packages are wasted in the accumulator unit 110 the input and output sensor of the accumulator unit 110 have been set as default.

Moreover, a good reason to set the input sensor and the output sensor
15 of the accumulator unit 110 as default is that a large number of packages may be held within the accumulator unit 110, thereby affecting the efficiency measure significantly if only measuring input packages to the packaging system and output packages from the packaging system. If however measuring packages input to the accumulator unit 110 and packages output
20 from the accumulator unit 110, and determining wasted packages when the accumulator unit is empty a more reliable efficiency measure is obtained.

The output sensors of the film wrapping units 120a, 120b can be set as default since these represent the output from the packaging system. Thus, by having a pair of machine unit sensors placed at the accumulator unit 110
25 and output sensors placed at the last machine unit or machine units of the packaging system, in this example the film wrapping machine units 120a, 120b, the main part of the number of wasted packages will be determined, since the main part of the packages are wasted in the accumulator unit 110, as well as the output from the packaging system 100 as a whole.

30 Based on the number of wasted packages and the number of output packages an efficiency measure may be determined by dividing the number of output packages with the total number of packages, which is determined by

adding the number of output packages with the total number of wasted packages.

Where to place the machine unit sensors depend on the design of the packaging system. In this particular example, the accumulator unit is chosen since packages are wasted in this machine unit and moreover because a large number of packages may be held within the accumulator unit 110. However, in other packaging systems other machine units may be of more interest to monitor. For instance, a packaging system may comprise a quality check machine unit arranged to check the packages and waste the packages not fulfilling preset standards. In such a case, machine unit sensors are preferably placed at this quality check machine unit since a number of packages are wasted in this machine unit.

The information about detected packages by the input sensors and the output sensors may be sent to a processing apparatus 122, such as a computer comprising a processor, a memory and a receiver for receiving the information from the sensors. The processing apparatus 122 may be configured to determine the efficiency measure as described above and to forward this to e.g. an operator panel.

The information about detected packages may be sent by wire or wireless using any present standard for sending information, such as UMTS and WiFi (IEEE 802.11).

Alternatively, instead of sending information from the sensor directly to the processing device, a machine unit processing device connected to the input sensor and the output sensor may be used to determine the number of wasted packages based on the information from the sensors. The information from the machine unit processing device may be sent to a packaging system processing device configured to collect information about wasted packages from the machine unit processing devices and the packaging system output sensors and based on this information determine and distribute the efficiency measure.

In order to make sure that reliable information is sent about wasted packages, the machine unit processing device may be configured to send information to the monitoring system processing device when the machine

unit is empty. In this way, the risk of counting the packages within the machine unit as wasted is eliminated. As described above, the machine unit processing device may determine when the machine is empty based on the information from the input sensor and the output sensor since the speed of the machine unit is known. If the speed varies, the speed may be input to the machine unit processing device continuously.

Figure 2 illustrates a side view of the accumulator unit 110 in greater detail. Packages 200 are fed via a conveyor 202 into the accumulator unit 110. Before entering the accumulator unit 110 an input sensor 204 is detecting the number of packages. The input sensor 204 may as in this example be placed next to the conveyor 202. In order to determine a number of output packages an output sensor 206 can be placed at the outfeed of the accumulator unit 110.

In this example, the input sensor 204 and the output sensor 206 send information to a machine unit processing device 208. The machine unit processing device can be configured to determine the number of input packages based on the information from the input sensor 204 and the number of output packages based on the information from the output sensor 206. Further, since the machine unit speed is known, the machine unit processing device 208 may determine if the accumulator unit 110 is empty or not. If the accumulator unit is empty, the number of wasted packages can be determined based on the number of input packages and the number of output packages and sent to a monitoring system processing device.

The communication between the input sensor 204 and the machine unit processing device 208, and the communication between the output sensor 206 and the machine unit processing device 208 may be via wire, as illustrated, or alternatively via wireless communication. The machine unit processing device 208 may be connected to a display 210 presenting the number of input and output packages.

Fig 3 illustrates a packaging system 300 in general. The packaging system 300 comprises a first position 302, a second position 304, a third position 306 and a fourth position 308. In this example, the second position 304 coincides with a rack loading position, i.e. a position where packages are

loaded onto a rack 310, and the third position 306 coincides with a rack unloading position, i.e. a position where packages are unloaded from the rack 310.

5 A first sensor 312, such as a photocell, placed in the first position 302 may be used for detecting a number of packages passing said first position 302. Further, a second sensor 314 placed in the second position 304 may be used for detecting a number of packages passing said second position 304. Based on the information from the first sensor 312 and the second sensor 314 a number of wasted packages between the first position 302 and the
10 second position 304 may be determined.

In order to improve the accuracy of the measurement of wasted packages, the number of wasted packages can be determined when the packaging line between the first position 302 and the second position 304 is empty. In order to determine that it is empty the speed of the packaging line
15 may be taken into account. Optionally, the first position 302 may be an infeed to a machine unit, such as an accumulator unit, and the second position 304 may be an outfeed from the machine unit.

In the same way, a third sensor 316 placed in the third position 306 and a fourth sensor 318 placed in the fourth position 308 may be used to
20 determine a number of wasted packages between a section of the packaging line extending between the third position 306 and the fourth position 308.

In the rack loading position, herein coinciding with the second position 304, the packages are loaded onto the rack 310. In order to keep track of the rack 310 it is provided with an identification tag, such as an RFID tag or an
25 optical mark. In the rack loading position an identity of the rack 310 is determined by using a first identification tag reader 320.

In the rack unloading position, herein coinciding with the third position 306, a second identification tag reader 322 may be used for reading the identity of the rack 310. By comparing the identity read in the rack loading
30 position by the first identification tag reader 320 and the rack unloading position by the second identification tag reader 322 it is possible to connect the rack 310 leaving the rack loading position with the rack 310 entering the rack unloading position.

By having the first identification tag reader 320, the second identification tag reader 322 and the identification tag on the rack 310, together providing the possibility to keep track of the rack 310 between the rack loading position and the rack unloading position, and by having the third
5 sensor 314, which also can be referred to as a rack load sensor, detecting packages being loaded onto the rack 310, and the fourth sensor 318, which also can be referred to as a rack unload sensor, detecting packages unloaded from the rack, a number of wasted packages between the second position 304 and the third position 306 can be determined. Further, another implication
10 is that a number of packages present between the third position 304 and the fourth position 306 can be determined. As described above, in order to get an accurate number of wasted packages, the number of wasted packages may be determined when no packages are present between the rack loading position and the rack unloading position.

15 In order to capture the problem of racks that are loaded, but never unloaded, a timer may be started when the rack 310 leaves the rack loading position. If the rack is not identified in the rack unloading position before the timer has elapsed, the packages of the rack 310 are considered to be wasted. The timer setting depend on what process steps that are taken place in the
20 batch equipment, herein illustrated by a retorting device 324. In this example, when carton-based packages held in the rack 310 are retorted, the timer may be set from 4 hours to 24 hours. The reason such a wide span may apply is because the packaging system may be run in different ways. For example, if the packages always are unloaded from the rack 310 after being retorted a
25 shorter period of time may be used, such as 4 hours. If instead the packages sometimes are left in the rack before or after they are retorted a longer period of time may be used, such as 24 hours or even longer.

Additionally, in order to provide the functionality of determining the number of wasted packages during the batch handling section of an existing
30 packaging system, a kit of parts may be provided. The kit of parts may comprise a rack load sensor for determining a number of packages loaded onto a rack in a rack load position of said packaging line, a first identification tag reader for determining an identity for said rack by reading an identification

tag provided on said rack in a batch processing start position of said packaging line, a second identification tag reader for determining said identity of said rack by reading said identification tag provided on said rack in a batch processing end position of said packaging line, and a rack unload sensor for
5 determining a number of packages unloaded from said rack in a rack unload position of said packaging line.

The information may be sent to a processing apparatus configured to determine that said rack in said batch processing start position is the same as said rack in the batch processing end position by comparing said identity
10 determined in said batch processing start position with said identity determined in said batch processing end position, and to determine a number of wasted packages in a packaging system with batch equipment by comparing said number of packages loaded onto said rack and said number of packages unloaded from said rack.

15 The processing apparatus may be a dedicated piece of hardware which may be comprised in the kit of parts, or the processing apparatus may be an existing piece of hardware to which the information is sent.

Fig 4 illustrates a method for determining wasted packages 400 in a packaging system comprising single package handling and batch handling.

20 In a single package handling section of the packaging system input packages are determined 402 in a first position. Next, in a second position, output packages are determined 404. Based on the number of input packages and the number of output packages a number of wasted packages can be determined 406.

25 Next, before leaving the single package handling section into a batch handling section, a number of packages loaded onto a rack is determined 408 and an identification of the rack is determined 410.

Then, before returning from the batch handling section, the identification of the rack is determined 412 and it is connected to one of the
30 racks identified in the rack loading position 414. After having identified the rack the number of packages of the rack is determined 416.

Based on the number of packages loaded onto the rack and the number of packages unloaded from the rack a number of wasted packages is determined 418.

5 Since packages may be wasted because whole racks may be lost during the batch handling section a timer may be started when having identified the rack in the rack loading position 420. If the timer has elapsed before the rack has been identified, and thereby concluded as returned from the batch handling section, the packages of that rack can be considered to be wasted 422.

10 After being unloaded from the rack, a number of input packages may be determined 424 and a number of output packages may be determined 426. Based on this information, in the same way as described above, a number of wasted packages may be determined 428.

15 Fig 5 illustrates a method for determining an efficiency measure for a packaging system 500. By using e.g. a sensor placed in the end of the packaging line a number of output packages for the packaging system can be determined 502. By using e.g. sensors placed in the packaging line of the packaging system as described above wasted packages can be determined. By collecting and processing the information from the sensors a total number
20 of wasted packages can be determined 504.

Based on the number of output packages and the total number of wasted packages, a number of input packages may be determined 506. For instance, by adding the number of output packages and the total number of wasted packages.

25 Finally, the efficiency measure can be determined 508, e.g. by dividing the number of input packages with the number of output packages.

The invention has mainly been described above with reference to a few embodiments. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible
30 within the scope of the invention, as defined by the appended patent claims.

CLAIMS

1. A monitoring system for a packaging system comprising batch equipment, said packaging system comprising a packaging line, said monitoring system comprising

5 a rack load sensor for determining a number of packages loaded onto a rack in a rack load position of said packaging line,

 a first identification tag reader for determining an identity for said rack by reading an identification tag provided on said rack in a batch processing start position of said packaging line,

10 a second identification tag reader for determining said identity of said rack by reading said identification tag provided on said rack in a batch processing end position of said packaging line,

 a rack unload sensor for determining a number of packages unloaded from said rack in a rack unload position of said packaging line, and

15 a processing apparatus configured to determine that said rack in said batch processing start position is the same as said rack in the batch processing end position by comparing said identity determined in said batch processing start position with said identity determined in said batch processing end position, and to determine a number of wasted packages in a
20 packaging system with batch equipment by comparing said number of packages loaded onto said rack and said number of packages unloaded from said rack.

2. The monitoring system according to claim 1, said monitoring system
25 further comprises

 a first sensor for determining a number of packages passing a first position of said packaging line,

 a second sensor for determining a number of packages passing a second position of said packaging line,

30 said first and second position being placed upstream said rack load position,

said processing apparatus being further configured to determine a number of wasted packages between said first position and said second position of said packaging line.

5 3. The monitoring system according to any one of claims 1 or 2, said monitoring system further comprising

 a third sensor for determining a number of packages passing a third position of said packaging line,

 a fourth sensor for determining a number of packages passing a fourth
10 position of said packaging line,

 said third and fourth sensor being placed downstream said rack unload position,

 said processing apparatus being further configured to determine a number of wasted packages between said third position and said fourth
15 position of said packaging line.

 4. The monitoring system according to any one of claims 1 to 3, further comprising

 an output sensor for determining number of packages output from said
20 packaging system,

 said processing apparatus being further configured to determine a total number of wasted packages for said packaging system, to determine a number of input packages by adding said number of output packages and said total number of wasted packages, and to determine an efficiency
25 measure by dividing said number of output packages with said number of input packages.

 5. The monitoring system according to any one of claims 1 to 4, wherein said identification tag provided on said rack is an RFID tag.

30

 6. The monitoring system according to claim 5, wherein said RFID tag is encapsulated in order to withstand retorting.

7. The monitoring system according to any of claims 1 to 6, wherein said sensors are photocells.

8. The monitoring system according to any one of the preceding
5 claims, wherein said rack load position coincides with said batch processing start position.

9. The monitoring system according to any one of the preceding
10 claims, wherein said rack unload position coincides with said batch processing end position.

10. The monitoring system according to any one of the preceding
claims, wherein said processing apparatus is further configured to start a
timer when said rack is identified in said batch processing start position, and if
15 said timer elapse before said rack is identified in said batch processing end position determine that said number of packages determined by said rack load sensor is wasted packages.

11. A method for determining a number of wasted packages in a
20 packaging system with batch equipment, said packaging system comprising a packaging line, said method comprising

determining a number of packages loaded onto a rack in a rack load position of said packaging line,

determining an identity for said rack by reading an identification tag
25 provided on said rack in a batch processing start position of said packaging line,

determining said identity of said rack by reading said identification tag provided on said rack in a batch processing end position,

determining that said rack in said batch processing start position is the
30 same as said rack in the batch processing end position by comparing said identity determined in said batch processing start position with said identity determined in said batch processing end position,

20

determining a number of packages unloaded from said rack in a rack unload position of said packaging line, and

determining said number of wasted packages in a packaging system with batch equipment by comparing said number of packages loaded onto
5 said rack and said number of packages unloaded from said rack.

12. The method according to claim 11, further comprising
starting a timer when said when said rack is identified in said batch
processing start position, and
10 if said timer elapse before said rack is identified in said batch
processing end position, determining that said number of packages
determined by said rack load sensor is wasted packages.

13. A method for determining a number of wasted packages for a
15 packaging system, said packaging system comprising a packaging line, said
method comprising
determining a first number of wasted packages between a first position
and a second position of said packaging line by determining a number of
packages passing said first position and a number of packages passing said
20 second position,
determining a second number of wasted packages according to any
one of claims 11 or 12, and
determining said number of wasted packages by adding said first and
said second number of wasted packages.

25

14. The method for determining a number of wasted packages
according to claim 13, further comprising
determining a third number of wasted packages between a third
position and a fourth position of said packaging line by determining a number
30 of packages passing said third position and a number of packages passing
said fourth position,

wherein said step of determining said number of wasted packages further comprises adding said third number of wasted packages to said first and said second number of wasted packages.

- 5 15. A method for determining an efficiency measure in a packaging system, said method comprising
- determining a number of output packages from said packaging system,
- determining a number of wasted packages according to any one of
- claims 11 to 14,
- 10 determining a number of input packages by adding said number of
- output packages and said number of wasted packages, and
- determining an efficiency measure by dividing said number of output
- packages with said number of input packages.
- 15 16. A computer program comprising computer program code adapted
- to perform any one of the methods of claim 11 to 15 when said program code
- is executed on a computer.
17. A computer program according to claim 16 embodied on a
- 20 computer readable medium.

1/5

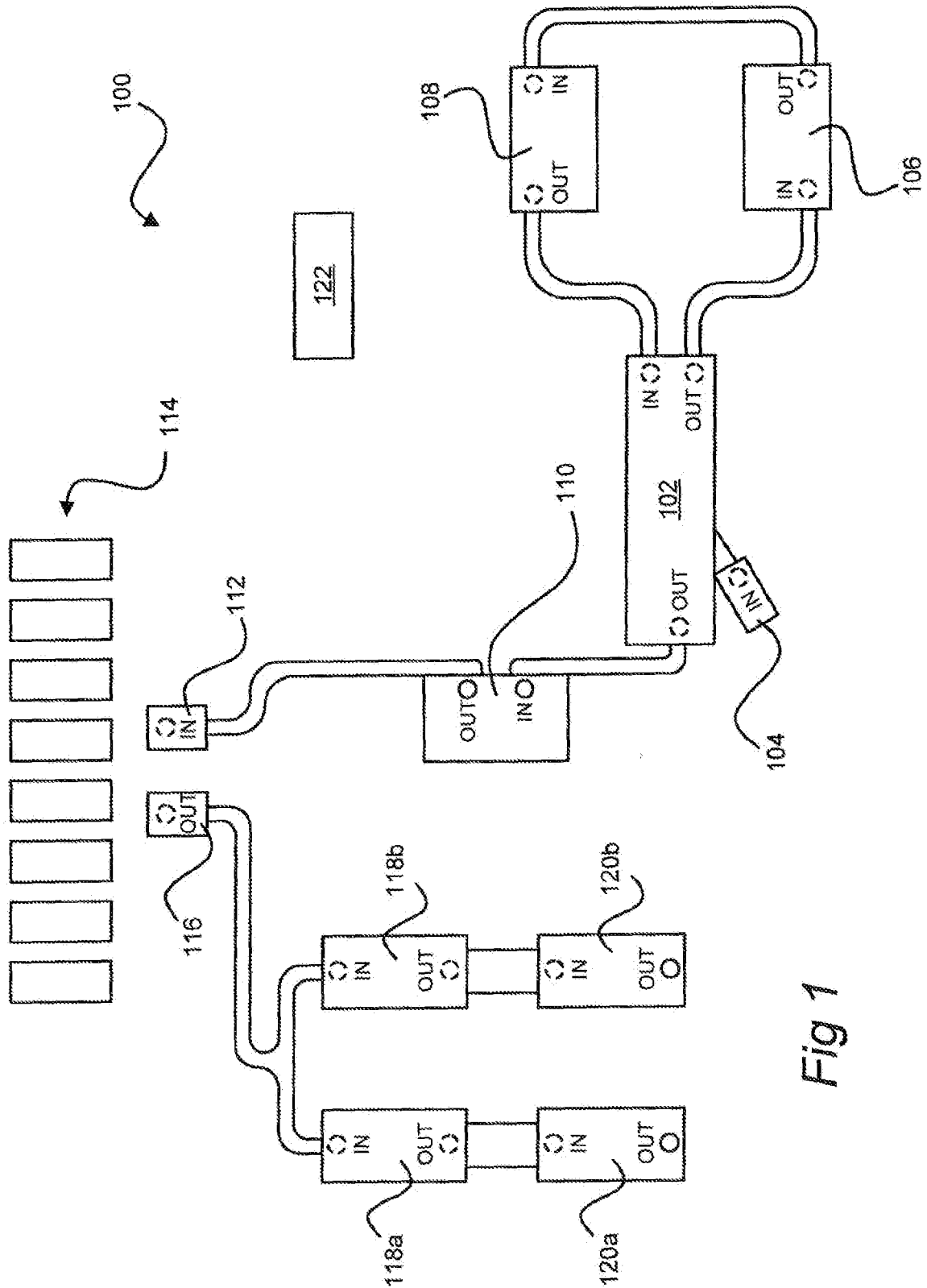


Fig 1

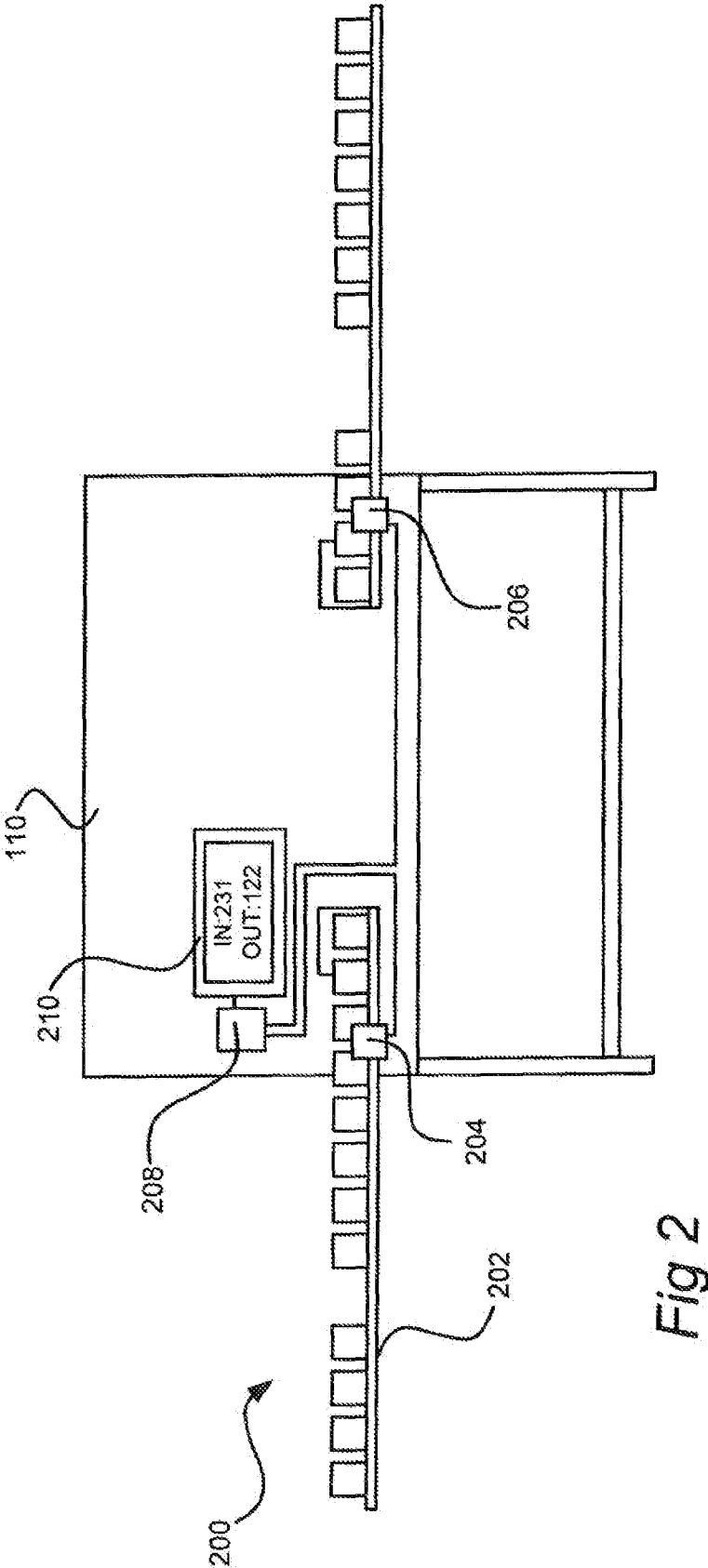


Fig 2

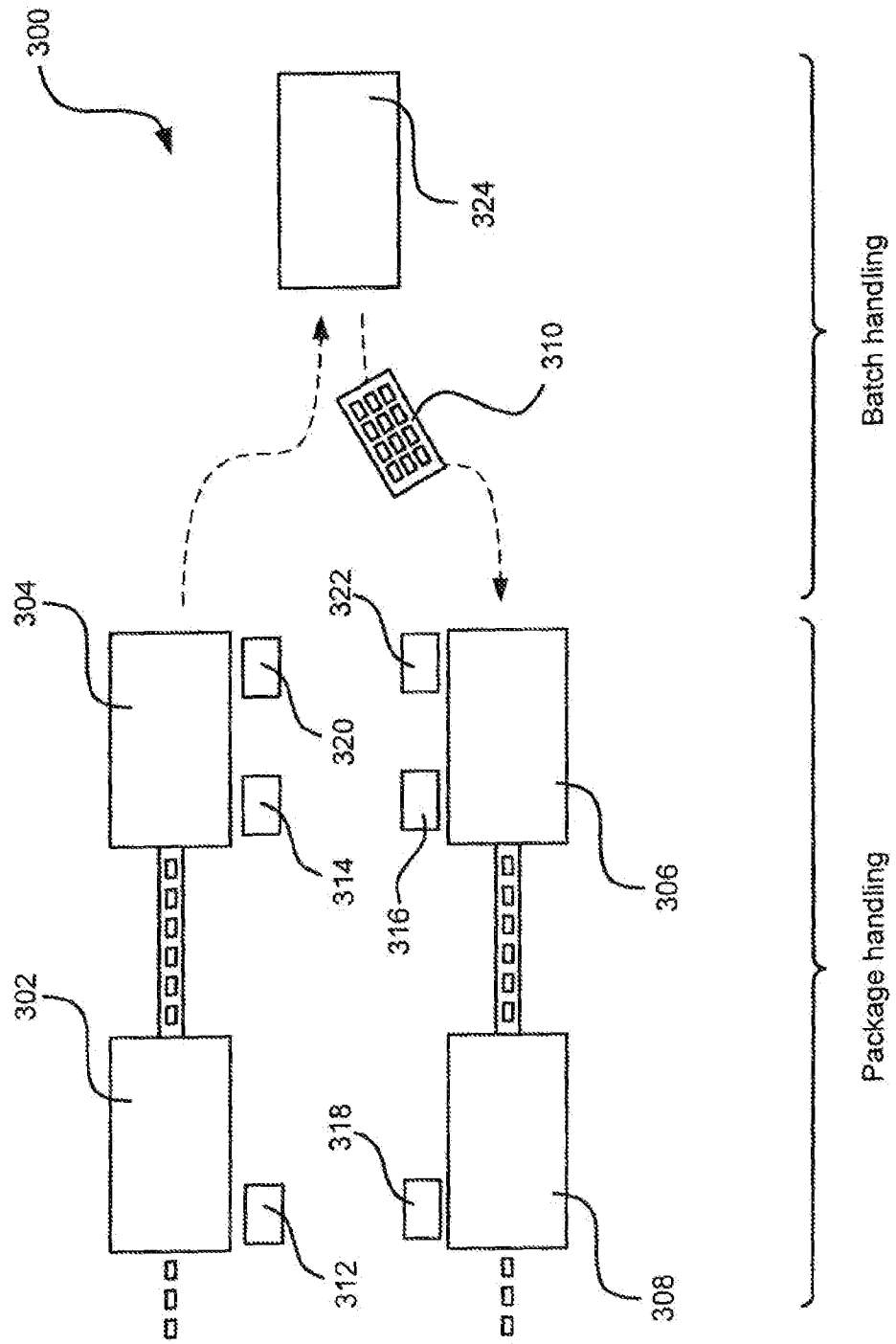


Fig 3

4/5

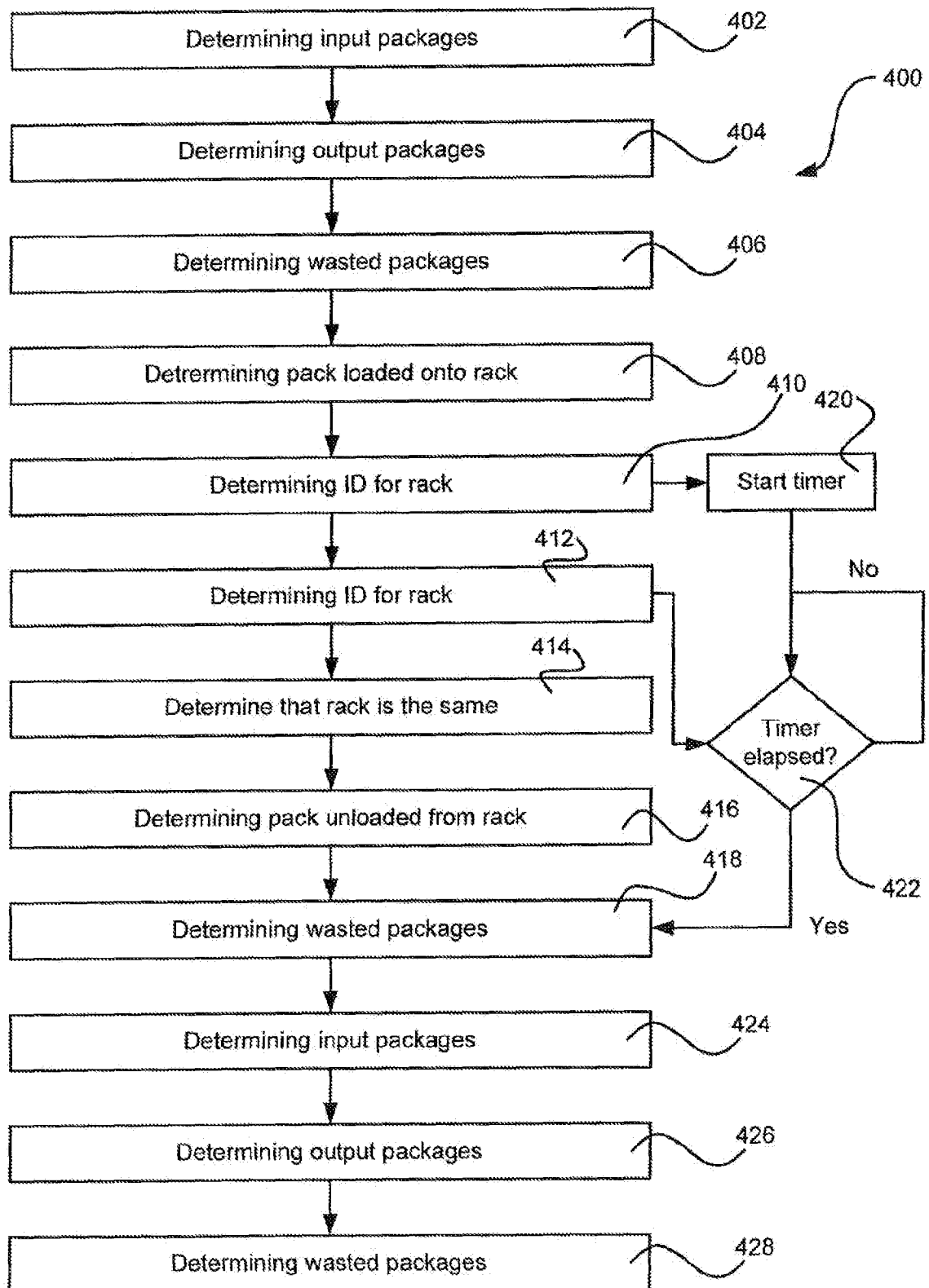
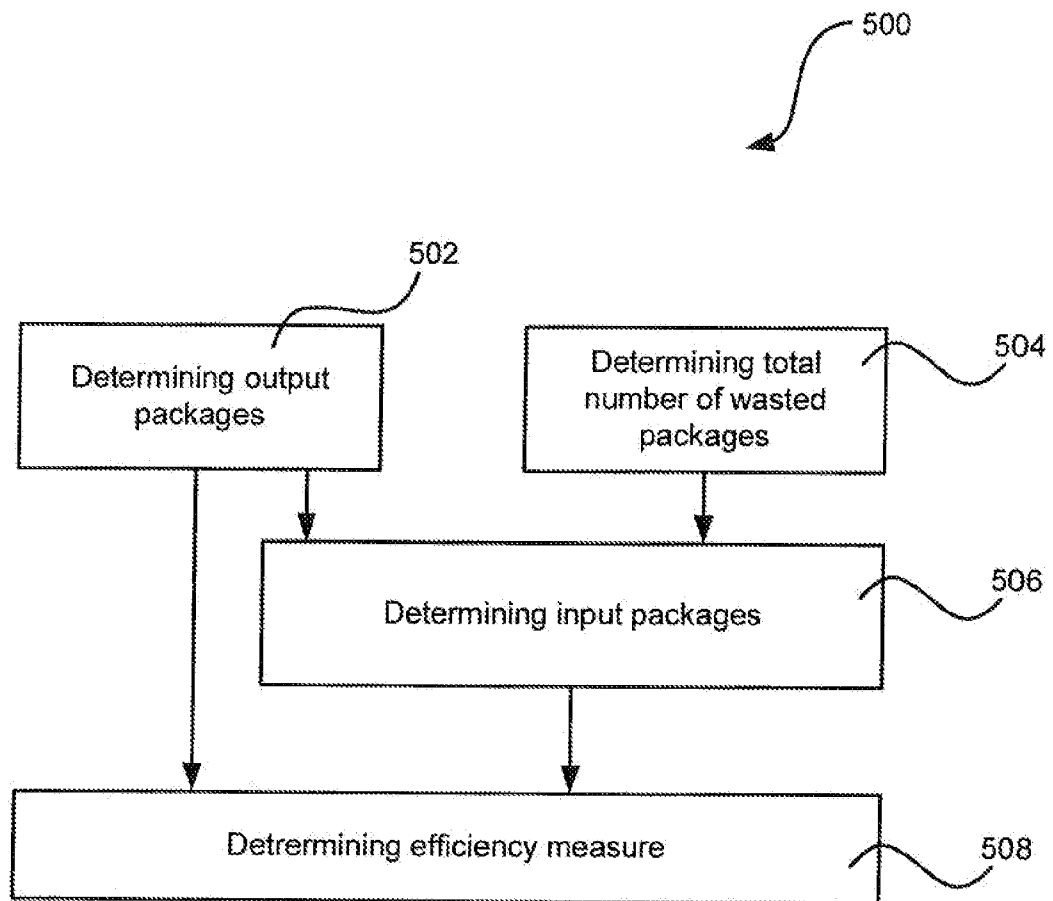


Fig 4

5/5

*Fig 5*