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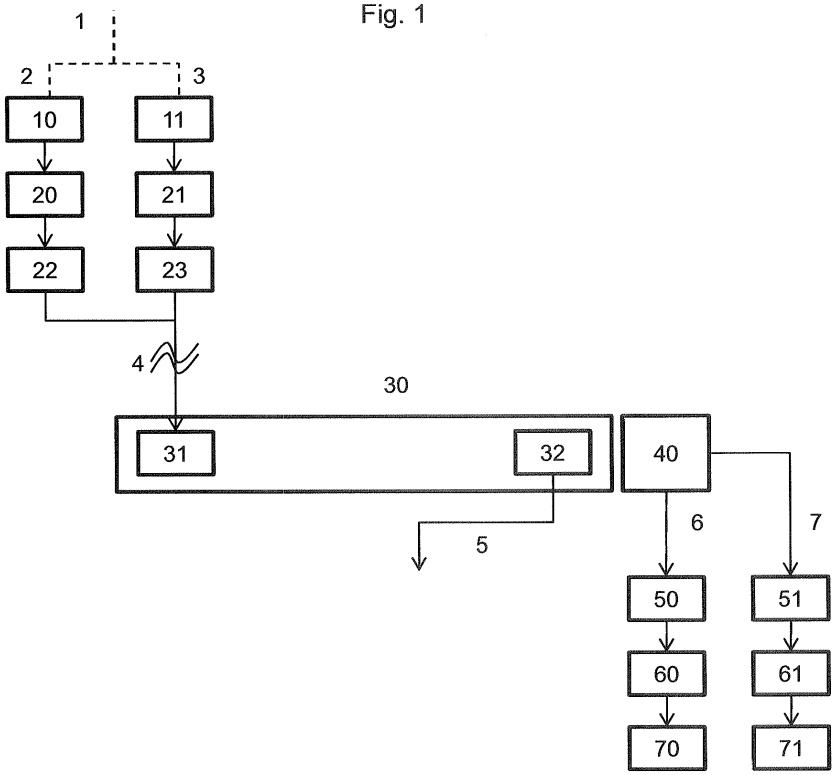
(54) Method and production line arrangement for processing objects at a high production speed

(57) The invention provides for a method for processing can bodies in a high-speed production line wherein objects, namely can bodies, are processed consecutively in several processing steps by several processing units, wherein in at least one processing step objects are processed in parallel by at least two different processing units (10, 11) and in at least one following processing step objects are processed by a single processing unit (30), comprising the steps marking a bottom of objects processed by a first of the at least two different processing units (10, 11) with a first mark, detecting marks on objects in the at least one following processing step, conveying objects to a first separation unit (40), transmitting detection results to the first separation unit such that for each object in the first separation unit a corresponding detection result for that object is available, separating objects marked with the first mark in the first separation unit.

Fig. 1



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Description

[0001] The invention relates to a method for processing objects in a high-speed production line wherein objects, namely can bodies for metal beverage cans, are processed consecutively in several processing steps by several processing units, wherein in at least one processing step objects are processed in parallel by at least two different processing units and in at least one following processing step objects are processed by a single processing unit.

[0002] Further the invention relates to a production line arrangement for processing objects at a high production speed, comprising several processing units for consecutively processing objects in several processing steps, with at least two different processing units for processing objects in parallel in at least one processing step and a single processing unit for processing objects and in at least one following processing step.

[0003] The invention further relates to a use of a high-speed separator as a sixth separating unit in a production line arrangement for processing objects at a high production speed or in a method for processing objects in a high-speed production line.

[0004] A method for processing objects in a high-speed production line as mentioned above is for example applied for producing the can bodies of metal beverage cans. Typically, can bodies for beverage cans are produced in a high-speed production line running at a speed of several thousand objects per minute, particularly more than 1000 objects per minute, preferably more than 3000 objects per minute, for example even more than 8000 objects per minute. The processing steps to form a can body are typically executed by several processing units in consecution and can include a cupper for cutting and cupping a cup out of a metal sheet, an ironing unit for ironing or redrawing the cup to form a basic can body, a trimming unit for trimming the upper rim of a can body, a washing unit for rinsing the inner and outer surfaces of a can body, a decorating unit for decorating, in particularly printing, the outer surface of a can body, a drying unit for drying a decorated can body, a varnishing unit for applying varnish to the inner surface of a can body, a necking unit for creating the neck and curling the rim on the upper, open end of a can body and testing it, and a palletizing unit for palletizing a number of processed can bodies in a packing piece-.

[0005] Usually, these processing steps are executed consecutively by the different processing units, i.e. objects travel from one processing unit to the next in a predefined order to pass through the different processing steps successively. However, one processing step may include different processing units that run in parallel. In this case, a stream of objects running through the production line is split up in at least two parallel streams of objects that are processed in parallel by at least two different processing units. Usually, after this at least one processing step in which the objects are processed in parallel, one or more processing steps follow in which the objects are again processed by a common processing unit, i.e. the parallel streams of objects are merged again to a single stream of objects.

[0006] The reason for providing for a processing step with a least two different processing units operating in parallel may be that these specific processing units operate at a lower speed than the other processing units of a high-speed production line. Therefore, operating two processing units in parallel at a lower speed instead of one can make for a higher speed of the production line as a whole.

[0007] However, dividing a single stream of objects into at least two parallel streams of objects in at least one processing step and merging the at least two streams of objects in a later processing step may lead to several problems. Typically, when the different streams of objects are merged, the sequence of the objects is disturbed, in particular, objects from the different streams usually mixed randomly in the merged stream. The tracking of objects and the tracking of processing units they have run through, for example, is thus complex. Further, the at least two different processing units have to execute the same kind of processing to ensure that the merged stream of objects contains the same kind of objects. Further, operating at least two different processing units in parallel in a processing step multiplies the possible sources for faults in the processing of objects.

[0008] Therefore, it is a first object of the present invention to provide for a method for processing objects in a high-speed production line as mentioned above that reduces or eliminates one or several of the above mentioned problems. Further, it is an object of the present invention to provide for a production line arrangement for processing objects at a high production speed as mentioned above that eliminates or reduces one or several of the above mentioned problems.

[0009] According to a first aspect of the invention, the object mentioned above is solved by a method for processing objects in a high-speed production line wherein objects, namely can bodies for metal beverage cans, are processed consecutively in several processing steps by several processing units, wherein in at least one processing step objects are processed in parallel by at least two different processing units and in at least one following processing step objects are processed by a single processing unit, comprising the steps marking objects processed by a first of the at least two different processing units with a first mark, wherein the first mark is applied to a bottom or dome of a can body, detecting marks on objects in the at least one following processing step in which objects are processed by the single processing unit, conveying objects to a first separation unit, transmitting detection results to the first separation unit such that for each object in the first separation unit a corresponding detection result for that object is available, separating objects marked with the first mark in the first separation unit based on the detection results.

[0010] The invention is based on the idea to provide objects processed by the first of the at least two different processing units with a first mark. Preferably, this is done in the processing step in which objects are processed in parallel, particularly at the end of this processing step. Preferably, a marking unit is used for marking the objects. By providing the objects processed in a first parallel stream of objects with a first mark, these objects can be identified later on, particularly after merging the different streams of objects. The at least one following process step in which objects are processed by a single processing unit can actually comprise a sequence of several processing steps in each of which objects are processed by a single processing unit.

[0011] The processed objects in the field of application for the inventive method and preferred embodiments are can bodies for metal beverage cans and the first mark is applied to a bottom or dome of a can body, preferably in a central region of the bottom or dome. The first mark is applied to the bottom of the can body that can also be identified as the dome of a can body. This location is advantageous for several reasons: first of all, the bottom or dome of a can body usually is not decorated and therefore marks do not interfere with a decoration pattern. Further, the bottom or dome of a can body is not in the focus of a user of a beverage can and therefore marks on the bottom are less irritating for users. A further and significant advantage is that, since the detection of marks takes place in a necking unit, the bottom of a can body is readily accessible for inspection. Therefore, detecting means, like a recognition camera, can be easily installed in a necking unit for detecting marks on the bottom of can bodies.

[0012] According to the invention marks on objects are detected in the at least one following processing step. This can be the first processing step after merging the different streams of objects or a second, third or any further processing step thereafter.

[0013] Thus, the objects can be identified after the two parallel streams of objects have been merged to a single stream of objects containing objects processed by the first of the at least two different processing units as well as objects processed by a second of the at least two different processing units.

[0014] Detecting marks on objects preferably comprises that every object, preferably marked as well as unmarked objects, is analyzed by a detecting unit and the objects marked with the first mark are identified, whereas objects with no, another or a deficient mark are not identified as objects with a first mark. The identification is preferably done by a detecting unit, which preferably comprises detecting means. The detection of marks on objects preferably is an optical detection, particularly using a recognition camera.

[0015] It is further preferred that the detection includes the generation of detection results, in this case the information if the detection of an object led to the identification of a first mark on that object or not.

[0016] According to the invention, after the detection the objects are conveyed to a first separation unit, preferably in a merged, single stream of objects. The conveying distance between the detection and the first separation unit can vary: The first separation unit can be located immediately after a detecting unit or the objects can be conveyed over a longer distance between being detected and reaching the first separation unit. In particular, one or more processing steps can take place between the detection and the first separation unit.

[0017] In the separation unit, the objects that carry the first mark are separated from the other objects. Preferably, the separation unit again divides the single stream of objects into at least two parallel streams of objects with one of the streams containing only objects with the first mark. The operation of separating can take place for example using compressed air, particularly if the objects are can bodies for metal beverage cans.

[0018] For the separating unit to be able to carry out the separation of objects with the first mark from other objects, the detection results gained in the step detecting marks on objects have to be transmitted to the first separation unit. This transmission has to be executed in a way that for each single object arriving in the first separation unit the information has to be present whether this precise object carries the first mark and thus shall be separated or not. Therefore, a stream of detection results corresponding to the stream of detected objects has to be transmitted to the first separation unit such that for every object in the separation unit the information about the corresponding detection result is present, i.e. the detection results have to be transmitted consistently to be objects to the first separation unit. Thus, if the sequence of objects changes between detection and separation, the sequence of detection results has to be changed accordingly.

[0019] The method according to the invention has several advantages. For example, the first separation unit does not have to carry out the detection of marks on the objects since these detection results are transmitted to the first separation unit. Particularly taking into account the high speed of the production line in question, this is an advantage. Further, by separating the objects with a first mark into a parallel separate stream of objects containing only objects with a first mark, these objects can be treated differently, for example aggregated in different packing pieces. Above all, the separation of the objects processed by the first of the at least two processing units provides for the possibility to have different processing operations executed by the at least two different processing units. For example, if the at least two different processing units are can decorators, these two different processing units can be run with different patterns creating differently decorated can bodies. Processing steps after the decoration of the can bodies can then be executed by single processing units, i.e. in a single stream of objects containing can bodies with different decorations. At a certain step in the processing, however, the

can bodies can be separated such that only can bodies with a first pattern or decoration are contained in a separate stream of objects leaving the separation unit. Since the alteration of patterns in a decoration unit is time-consuming, the present invention has the advantage to provide for the opportunity to only change one of two decorators to produce different patterns.

[0020] A preferred embodiment is characterized in that the step conveying objects to the first separation unit is part of the processing step in which objects are processed by the single processing unit, wherein preferably the single processing unit is a necking unit for necking can bodies for metal beverage cans.

[0021] After the detection of marks and before the separation the objects are processed in the single processing unit. After being detected for marks, the objects run through the processing step in the single processing unit while being conveyed to the first separation unit.

[0022] Therefore, in a preferred embodiment a detection unit can be followed by one or several single processing units, followed by the first separation unit. For example, in a preferred embodiment a detection unit can be followed only by the necking unit as the single processing unit or by several, in particular different, single processing units, followed by the first separation unit. This has the particular advantage, that the detection of marks can occur not only directly before the first separation unit but one ore more processing steps before the first separation unit. That means that the objects - after being detected and after detection results have been generated - can be processed in at least one processing step by a single processing unit before reaching the first separation unit. Therefore, the detection results preferably are transmitted to the first separation unit accordingly such that, as described above, consistent information regarding the detection result for a specific can are available at the first separation unit. For example, it can be preferred that the processing steps between the detection and the separation do not change the sequence of the objects so that they are still aligned with the sequence of detection results.

[0023] In a preferred embodiment the first separation unit is a part of the necking unit. It is particularly preferred that the first separation unit is the last station of the necking unit.

[0024] In an alternative preferred embodiment the first separation unit is positioned after the necking unit.

[0025] It is particularly preferred that the single processing unit by which the objects are processed while being conveyed to the first separation unit is a necking unit for necking can bodies for metal beverage cans. This is particularly preferred since in a typical high-speed production line for can bodies the necking unit is a station near the end of the production process, often the last processing step before the can bodies are palletized. Therefore, it is preferred that the separation of objects takes place after the main processing steps but before palletizing, so that the separated objects can be processed by a different palletizer than the other objects and thus packaging pieces are generated with either objects with a first mark or objects without a first mark.

[0026] A further preferred embodiment is characterized in that the step detecting marks on objects is carried out by the single processing unit, preferably by a subunit of the single processing unit.

[0027] In this embodiment it is preferred that the detection takes place in the single processing unit. It is particularly preferred that this is the same single processing unit that processes the objects while they are being conveyed to the first separation unit. An example for a particularly preferred arrangement is detection at the beginning of a necking unit followed by separation in the first separation unit following the necking unit.

[0028] It is particularly preferred to apply the first marks in the middle of the bottom or dome or in a central region. This location facilitates the alignment of detection means for detecting the marks reliably.

[0029] A further preferred embodiment is characterized in that the first mark is a laser, preferably a fiber laser, mark, a colour mark, a barcode or a label.

[0030] Preferably, the first mark is a laser mark, particularly a fiber laser mark. The first mark can have a geometrical shape, for example a triangle, a square, a star, a cross or a circle. The first mark can also be in the form of a (capital) letter or a number. The mark can also be a combination of letters, numbers and/or geometrical shapes.

[0031] The first mark can also be a colour mark, for example created by applying a certain colour pattern in a specific location of the can. The first mark can also be a barcode. Another possibility is to apply the mark in form of a label to the bottom of a can body.

[0032] A detection unit preferably comprises detection means that are suitable to detect the specific kind of marks used.

[0033] A further preferred embodiment is characterized in that the at least two different processing units are decorating units for decorating can bodies for metal beverage cans or embossing units for embossing can bodies for metal beverage cans.

[0034] In the preferred field of application of producing can bodies for metal beverage cans it is particularly preferred that the at least two different processing units are those units that change the optical appearance of the outer cylindrical surface of a can body, i.e. decorating or printing units for applying a colour pattern to the outer cylindrical surface or embossing units for changing the cylindrical wall of the can body by embossing.

[0035] If the at least two different processing units decorate the objects with different patterns or emboss them with different embossing patterns, it is important to separate the different patterns after one or more following processing steps in which a single stream of objects containing objects with different kinds of patterns are processed.

[0036] A further preferred embodiment is character-

ized by the steps marking objects processed by a second of the at least two different processing units with a second mark, separating objects marked with the second mark in the first separation unit based on the detection results.

[0037] Preferably also the objects that are processed by the second of the at least two different processing units are marked, in particular with a second mark that is different from the first mark. In the first separation unit the objects with the second mark are separated from the objects marked with the first mark. It is preferred that after the separation unit at least two parallel streams of objects emerge; one containing objects marked with the first mark and one containing objects marked with the second mark. Preferably, the detection unit comprising detection means suitable for detecting different marks, particularly first and second marks.

[0038] It is further preferred, that this process can be extended for marking objects with third, fourth and further marks and separating objects marked with those third, fourth or further marks in the first separation unit based on the detection results generated by detecting third, fourth or further marks. The information and details given above for the first and/or second mark apply accordingly for the third, fourth or further marks.

[0039] A further preferred embodiment is characterized by the steps marking objects processed by a third different processing unit in parallel with the at least two different processing units with a third mark, separating objects marked with the third mark together with the objects marked with the second mark in the first separation unit based on the detection results, conveying objects marked with the third mark together with the objects marked with the second mark to a second separation unit, transmitting the detection results to the second separation unit such that for each object in the second separation unit a detection result for that object is available, separating objects marked with the third mark from the objects marked with the second mark in the second separation unit based on the detection results.

[0040] This embodiment provides a solution for the case that at least three different processing units process objects in parallel and the objects shall be marked with at least three different marks accordingly, while at the same time the first separation unit is only capable of separating a stream of objects into two separated streams and not into three separated streams. In this case, the first unit can be configured to separate only can bodies with one of the three marks, for example can bodies with the first mark, into a separate stream of objects. The second stream of objects generated by the first separation unit still contains objects marked with the second and the third mark. Therefore, this stream of objects containing objects with the second and third marks are conveyed to a second separation unit in which again two separate streams of objects are generated by separating the objects with the second mark from the objects with the third mark. Preferably, the detection results from the detecting step are transmitted consistently to the second separation unit such that for each of the objects arriving at that second separation unit the corresponding detection result is available with the information if the object is marked with the first, the second, the third or none of these marks.

[0041] This embodiment therefore provides for the separation of three different kinds of objects created in three different processing units in parallel while at the same time using separation units that are only capable of generating two different streams of objects and therefore may be more readily available than separation units capable of generating three or more different streams of objects. This embodiment can also be extended for applying fourth, fifth and further marks to objects processed by a fourth, fifth or further different processing units in parallel by arranging further separation units in sequence.

[0042] A further preferred embodiment is characterized by the steps verifying if the first mark on objects processed by the first of the at least two different processing units is correct, missing or deficient before the at least one following processing step in which objects are processed by the single processing unit, and/or verifying if the second mark on objects processed by the second of the at least two different processing units is correct, missing or deficient before the at least one following processing step in which objects are processed by the single processing unit, and/or verifying if the third mark on objects processed by the third different processing unit is correct, missing or deficient before the at least one following processing step in which objects are processed by the single processing unit.

[0043] In a preferred embodiment the first, second and/or third marks are checked after they are applied. This step of verifying the marks is preferably done while the streams of objects still run in parallel and have not yet merged after being processed by different processing units. This testing of the marks during or right after the processing step in which the marks are applied and/or the different processing units process the objects has the advantage that faults in a marking unit or the marking process can be identified early on.

[0044] A further preferred embodiment is characterized by the step separating objects with a missing, deficient or unknown mark.

[0045] In this embodiment objects without a mark or with a faulty mark are separated from the further processing of the other objects with correct marks. Separating units with a missing, deficient or unknown mark has the advantage that packaging pieces of palletized objects at the very end of the production line are free from those objects with a missing, deficient or unknown mark or separate packaging pieces specifically for these objects with the missing, deficient or unknown marks can be generated.

[0046] The separation of objects with a missing, deficient or unknown mark can be done at different processing steps. For example, the objects without a mark or with a faulty mark can be separated immediately before

the different streams of objects merge so that the number of objects without a mark or with a faulty mark or an incorrect mark in the further process can be reduced. Preferably, these objects are separated by a verifying unit. When these objects are to be separated by one or more further separation units, it is preferred that verifying results are generated and transmitted consistently with the objects to the one or more separation units.

[0047] Further, objects with a missing, deficient or unknown mark can be identified in the detecting step and then separated based on the detection results.

[0048] A preferred embodiment is characterized by the steps separating objects with a missing or deficient first mark in a third separation unit before the at least one following processing step in which objects are processed by the single processing unit, and/or separating objects with a missing or deficient second mark in a fourth separation unit before the at least one following processing step in which objects are processed by the single processing unit, and/or separating objects with a missing or deficient third mark in a fifth separation unit before the at least one following processing step in which objects are processed by the single processing unit.

[0049] The present embodiment provides for separate separation units in the processing steps in which the objects are processed in parallel by different processing units. Preferably, these separation units are provided with corresponding verifying and/or detection results for a correct separation.

[0050] A further preferred embodiment is characterized by the step separating objects with a missing, deficient or unknown mark in the first separation unit.

[0051] If the first separation unit is capable of separating not only objects marked with a first mark, but also for separating objects with a missing deficient or unknown mark these objects can also be separated in the first separation unit. Preferably, the first separation unit is provided with corresponding verifying and/or detection results for a correct separation of objects with a missing, deficient or unknown mark.

[0052] A further preferred embodiment is characterized by the step separating objects with a missing, deficient or unknown mark in a sixth separating unit, which is preferably located before the first separating unit, wherein preferably the sixth separating unit is a sub-unit, preferably a testing unit, of the single processing unit.

[0053] The objects with a missing, deficient or unknown mark can also be separated in an additional separation unit, preferably before the first separation unit. This embodiment is, for example, preferred in case the first separation unit is not capable of separating objects with a missing, deficient or unknown mark in addition to separating objects with the first mark. In a particularly preferred embodiment the separation of objects with a missing, deficient or unknown mark is carried out by a sub-unit in the single processing unit located before the first separation unit, in particular in a testing unit that is part of the single processing unit.

[0054] For example, if a single processing unit is a necking unit, the necking unit usually comprises a testing unit, for example a light testing unit, that is configured to separate deficient can bodies. It is preferred to transmit the detection results and/or verifying results to this testing unit of the necking unit such that the necking unit can - preferably in addition to deficient can bodies - separate those can bodies with a missing, deficient or unknown mark.

[0055] Separation of objects with a missing, deficient or unknown mark can also take place at multiple steps in the process, for example to provide for a redundant configuration and/or a more reliable separation result.

[0056] According to a further aspect of the invention, the object is achieved by a production line arrangement for processing objects at a high production speed, comprising several processing units for consecutively processing objects, namely can bodies for metal beverage cans, in several processing steps, with at least two different processing units for processing objects in parallel in at least one processing step and a single processing unit for processing objects and in at least one following processing step, comprising further a first marking unit for marking objects processed by a first of the at least two different processing units with a first mark on the bottom or dome of a can body, a first detecting unit for detecting marks on objects in the at least one following processing step in which objects are processed by the single processing unit, a conveying unit for conveying objects to a first separation unit, a transmission connection to transmit detection results to the first separation unit such that for each object in the first separation unit a detection result for that object is available, wherein the first separation unit is arranged to separate objects marked with the first mark based on the detection results.

[0057] As to the advantages, preferred embodiments and details of this further aspect and its preferred embodiments, reference is made to the corresponding advantages, details and embodiments described above.

[0058] According to a further aspect of the invention, the object is solved by use of a high-speed separator as the first, second, third, fourth, fifth and/or sixth separating unit in a production line arrangement for processing objects at a high production speed as described above or in a method for processing objects in a high-speed production line according as described above.

[0059] Again, as to the advantages, preferred embodiments and details of this further aspect and its preferred embodiments, reference is made to the corresponding advantages, details and embodiments described above.

[0060] A preferred embodiment of the invention shall now be described with reference to the attached drawing, in which

Fig. 1: is a schematic depiction of a part of an embodiment of a production line arrangement according to the invention for carrying out a part of an embodiment of the method for processing ob-

jects according to the invention.

[0061] The field of application for the part of the production line arrangement according to Fig. 1 is the production of can bodies for metal beverage cans. The can bodies are processed consecutively in several processing steps in a single stream of can bodies indicated with dashed line 1. This stream of objects is divided into two different streams 2, 3 of objects wherein at least one processing step is carried out in parallel by at least two different processing units.

[0062] In the example depicted in Fig. 1, the objects are processed in parallel by two decorators 10, 11. After the application of a color pattern in the decorators 10, 11, the objects in the two different streams of objects 2, 3 are then marked by marking units 20, 21 with a fiber laser. The stream of objects 2 being processed by the decorator 10 is marked with a first mark by the marking unit 20. The stream of objects 3 processed by the decorator 11 is marked with a second mark by the marking unit 21 with a fiber laser.

[0063] As an optional, quality-enhancing measure, the first and second marks applied by the marking units 20, 21 are verified by verifying units 22, 23.

[0064] After that, the two different streams of objects 2, 3, are merged to a single stream of objects 4 comprising can bodies marked with first and second marks. Before the objects reach the single processing unit 30, one or several processing units can be arranged in between to perform one or several consecutive processing steps.

[0065] Preferably, all processing units that process a single stream of objects operate at line-speed. Those processing units that process different streams of objects in parallel can operate at a lower speed.

[0066] In the preferred embodiment the detection of marks is carried out by the single processing unit 30 that is a necking unit. A first sub-unit of the necking unit 30 is a detection or recognition unit 31 for detecting marks on the can bodies in the at least one following processing step in which the can bodies are processed by the single processing unit 30. The detection or recognition unit 31 generates detection results containing information whether a specific can body is marked with the first mark, the second mark, with no mark or with a deficient or unknown mark. These detection results are transmitted to the first separation unit 40 and preferably also to the light testing unit 32 at the end of the necking unit 30. The detection results are transmitted such that for each can body in the first separation unit 40 and preferably also for each can body in the light testing unit 32 a corresponding detection result for that specific can body is available. Preferably, either in the necking unit the sequence of can bodies must not be changed or the sequence of the detection results has to be changed according to any changes occurring in the sequence of the can bodies being conveyed through the necking unit 30 to the first separation unit 40. In the separation unit 40, the single stream of can bodies is again separated into two different streams of objects 6, 7 in that can bodies marked with the first mark are conveyed in stream 6 and can bodies marked with the second mark are conveyed in stream 7.

[0067] Preferably, the light testing unit 32 as the last station of the necking unit 30 already separates can bodies with no, a deficient or unknown mark into a separate stream 5.

[0068] After the first separation unit 40 the can bodies are inspected in final inspection units 50, 51 and then palletized in palletizing units 60, 61 and provided as packaging pieces 70, 71. Since the first separation unit 40 separates can bodies with the first mark form the ones with the second mark, the packaging piece 70 only contains can bodies with the first mark and the packaging piece 71 contains only can bodies with the second mark.

[0069] Preferably, the first separation unit 40 is part of the necking unit 30. It is particularly preferred that the first separation unit 40 is the last station of the necking unit 30. In an alternative embodiment the first separation unit 40 can be positioned after the necking unit 30.

[0070] Advantageously, different patterns can be applied by the two different processing units 10, 11, in this case decorating units, while the rest of the production line can be processed with a single stream of objects at line speed and still the differently decorated can bodies can be provided in sorted packaging pieces 70, 71 at the end of the process.

Claims

1. Method for processing objects in a high-speed production line wherein objects, namely can bodies for metal beverage cans, are processed consecutively in several processing steps by several processing units, wherein in at least one processing step objects are processed in parallel by at least two different processing units (10, 11) and in at least one following processing step objects are processed by a single processing unit (30),
comprising the steps

   - marking objects processed by a first of the at least two different processing units (10, 11) with a first mark, wherein the first mark is applied to a bottom or dome of a can body,
   - detecting marks on objects in the at least one following processing step in which objects are processed by the single processing unit (30),
   - conveying objects to a first separation unit (40),
   - transmitting detection results to the first separation unit (40) such that for each object in the first separation unit (40) a corresponding detection result for that object is available,
   - separating objects marked with the first mark in the first separation unit (40) based on the detection results.

2. Method according to claim 1, **characterized in that** the step conveying objects to the first separation unit (40) is part of the processing step in which objects are processed by the single processing unit (30), wherein preferably the single processing unit (30) is a necking unit for necking can bodies for metal beverage cans.

3. Method according to any of the previous claims, **characterized in that** the step detecting marks on objects is carried out by the single processing unit (30), preferably by a sub-unit of the single processing unit (30).

4. Method according to any of the previous claims, **characterized in that** the first mark is applied in a central region of the bottom or dome.

5. Method according to any of the previous claims, **characterized in that** the first mark is a laser mark, preferably a fiber laser mark, a colour mark, a barcode or a label.

6. Method according to any of the previous claims, **characterized in that** the at least two different processing units (10, 11) are decorating units for decorating can bodies or embossing units for embossing can bodies.

7. Method according to any of the previous claims, **characterized by** the steps

- marking objects processed by a second of the at least two different processing units (10, 11) with a second mark,
- separating objects marked with the second mark in the first separation unit (40) based on the detection results.

8. Method according to any of the previous claims, **characterized by** the steps

- marking objects processed by a third different processing unit in parallel with the at least two different processing units (10, 11) with a third mark,
- separating objects marked with the third mark together with the objects marked with the second mark in the first separation unit (40) based on the detection results,
- conveying objects marked with the third mark together with the objects marked with the second mark to a second separation unit,
- transmitting the detection results to the second separation unit such that for each object in the second separation unit a detection result for that object is available,
- separating objects marked with the third mark from the objects marked with the second mark in the second separation unit based on the detection results.

9. Method according to any of the previous claims, **characterized by** the steps

- verifying if the first mark on objects processed by the first of the at least two different processing units (10, 11) is correct, missing or deficient before the at least one following processing step in which objects are processed by the single processing unit (30), and/or
- verifying if the second mark on objects processed by the second of the at least two different processing units (10, 11) is correct, missing or deficient before the at least one following processing step in which objects are processed by the single processing unit (30), and/or
- verifying if the third mark on objects processed by the third different processing unit is correct, missing or deficient before the at least one following processing step in which objects are processed by the single processing unit (30).

10. Method according to any of the previous claims, **characterized by** the step

- separating objects with a missing, deficient or unknown mark.

11. Method according to the previous claim, **characterized by** the steps

- separating objects with a missing or deficient first mark in a third separation unit before the at least one following processing step in which objects are processed by the single processing unit (30), and/or
- separating objects with a missing or deficient second mark in a fourth separation unit before the at least one following processing step in which objects are processed by the single processing unit (30), and/or
- separating objects with a missing or deficient third mark in a fifth separation unit before the at least one following processing step in which objects are processed by the single processing unit.

12. Method according to any of the two previous claims, **characterized by** the step

- separating objects with a missing, deficient or unknown mark in the first separation unit (40).

13. Method according to any of the previous claims 10-12, **characterized by** the step

- separating objects with a missing, deficient or unknown mark in a sixth separating unit, which is preferably located before the first separating unit (40), wherein preferably the sixth separating unit is a sub-unit, preferably a testing unit, of the single processing unit (30).

14. Production line arrangement for processing objects at a high production speed, comprising several processing units for consecutively processing objects, namely can bodies for metal beverage cans, in several processing steps, with at least two different processing units (10, 11) for processing objects in parallel in at least one processing step and a single processing unit (30) for processing objects and in at least one following processing step, comprising further

- a first marking unit (20, 21) for marking objects processed by a first of the at least two different processing units (10, 11) with a first mark on the bottom or dome of a can body,
- a first detecting unit (31) for detecting marks on objects in the at least one following processing step in which objects are processed by the single processing unit (30),
- a conveying unit for conveying objects to a first separation unit (40),
- a transmission connection to transmit detection results to the first separation unit (40) such that for each object in the first separation unit (40) a detection result for that object is available,
- wherein the first separation unit (40) is arranged to separate objects marked with the first mark based on the detection results.

15. Use of a high-speed separator as the first, second, third, fourth, fifth and/or sixth separating unit (40) in a production line arrangement for processing objects at a high production speed according to the previous claim or in a method for processing objects in a high-speed production line according to any of the previous claims 1-14.

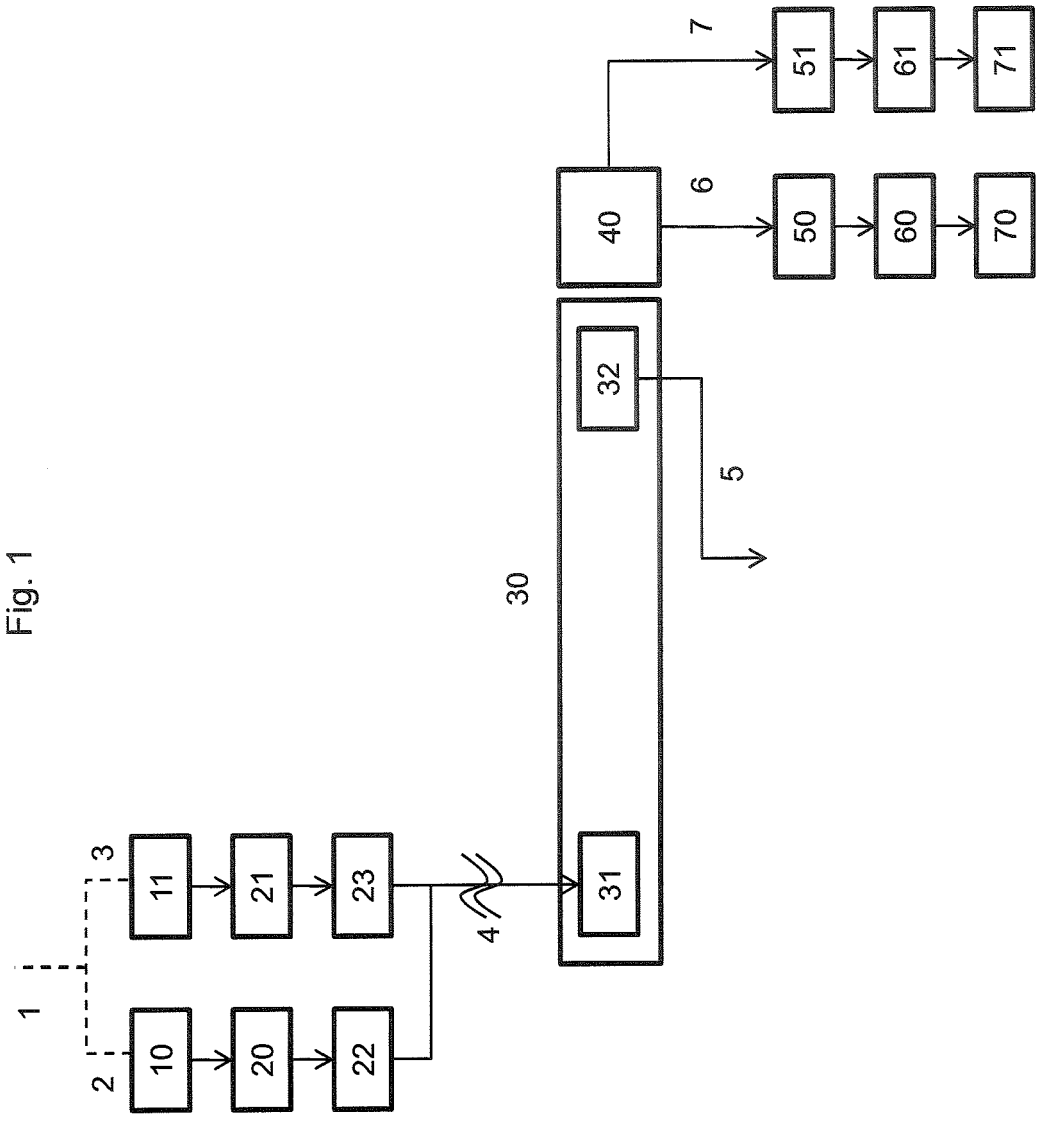

Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 12 17 0589

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 August 2012	Cano Palmero, A

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