METHOD AND SYSTEM FOR THE CUTTING-UP OF ITEMS SUCH AS PIECES OF MEAT

Abstract: Method and system for cutting-up of items such as, for example, pieces of meat, where scanning equipment is used for the determination of dimensional data of an item, and where a machine, for example a portion cutter, is used for the cutting-up of the said items/pieces of meat. By means of control means at least one part of the item, i.e. a part-item, is determined, which fulfils a predetermined criterion as regards the weight, and which furthermore fulfils related criteria for thickness and the number of slices into which said at least one part of the item can be cut.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
Method and system for the cutting-up of items such as pieces of meat

Field of the invention

The invention relates to a method and a system for the cutting-up of items such as, for example, pieces of meat, where an item is scanned for determining dimensional data for the item and where on the basis hereof one or more cutting positions are determined.

Background of the invention

For the mechanical dividing of large pieces of meat into steaks, use is typically made of a so-called portion cutter.

A portion cutter is a machine with a number of conveyor belts, a computer vision system, a knife and a control unit. Typically, there are two conveyor belts which are arranged end to end with a relatively small gap between them. The computer vision system can also be called a scanning system. The knife is typically of the "sword" type, i.e. a relatively long knife which is arranged at the side of the gap between the two conveyor belts. When a portion is to be cut from the piece of meat, this takes place when the place at which the piece of meat is to be cut is lying over the gap between the two conveyor belts, and the cut is carried out by the knife being rotated once at high speed, whereby the piece of meat is cut through.

In fig. 1 there is shown an example of a portion cutter indicated in general by the reference number 1, and which for example can be used in connection with the invention. The items to be cut, for example pieces of meat 10, are transported on an inlet conveyor belt 2 forward to the machine where the piece of meat is first scanned 4, for example by means of laser vision equipment, X-ray equipment, ultrasonic equipment or similar measuring/scanning equipment. On the basis of this scanning, a number of pieces which fulfil certain criteria is determined, as will be explained in
more detail in the following, and a cutting-up of the piece of meat 10 into portions and possibly trim pieces is carried out. As mentioned, this cutting-up is carried out for example with a rotating knife or the like, as will also be described in more detail later.

The term "portion cutter" describes that the piece of meat is cut-up into portions, and the term "portion" is the term often used for the small pieces of meat. However, for practical reasons, in the following use will be made of the term "slices", since in the following the term portion will be used in a different manner. The machine can be used for the cutting of things other than meat, e.g. fish, poultry and cheese etc. Therefore, in the following, the term "slice" will be used instead of the term steak. For corresponding reasons, the "pieces of meat" will be called "items".

In this description there will furthermore be provided a more detailed explanation of an example of how a portion cutter functions.

Items such as those described are often sold in fixed-weight packages, i.e. that there are e.g. four slices in a pack which is sold as 600 g. There are rules for how it is determined whether such a pack fulfils the rules for contents, but the main rule which applies is that it must contain at least 600 g. In the following, items which are determined to form a pack will be termed as a "batch".

With the above-mentioned fixed-weight packaging operations, the slices are most often cut at the same weight and are packed afterwards.

The batch process can be a simple counting operation such that a certain number of slices are counted up to form a batch. For example, if all the slices have been cut at 150 g, and if four of such slices are placed in a batch, the batch weight will thus be 600 g.
There will naturally arise a certain deviation in the weight of the slices. When the machine has been set to cut slices of 150 g, some will weigh a little less and others a little more.

If the inaccuracy of such batches is unacceptably great, and it is necessary therefore to cut slices of e.g. 152 g to ensure that all the batches contain what they shall, the result is that the overweight in the batches is on average 8 g, corresponding to 1.33%. This is generally considered as "give away" because the producer does not receive payment for it, and naturally it is desired that this amount be reduced as much as possible.

One way in which this give away can be reduced is to cut the slices smaller and use a batch weighing machine to select those slices which are best suited together in a batch, and hereby reduce the overweight. Such a batch-weighing machine can e.g. be a multi-head combination weighing unit or a machine which works in accordance with the principles described in for example GB 2 116 732 and EP 781 172.

It is a problem, however, regardless of whether or not use is made of a batch-weighing machine, that the slices are not of the same thickness and therefore do not have the same frying or roasting time.

This problem is solved with the present invention.

The solution is first to define the batches, i.e. those places on the item which must be cut to fulfil the batch weight, and thereafter to define the cutting positions for the slices in such a manner that they have the same thickness. Finally, the cutting itself is carried out.

Moreover, for practical reasons it will be carried out so that the slices which belong together for a batch will lie closer together on the conveyor belt which conveys the slices out of the machine than the last slice of a batch and the first slice of the
subsequent batch. This separation can be effected by introducing a pause in the cutting-up between each part item.

In the following, use will be made of the term "part item" about such a part of the item which weighs that which a batch shall weigh.

Among other things, use will be made in the following of the following terms:

Item: to be understood as that item, including e.g. a meat piece, which is the raw material for the process which is relevant in this context. In the foregoing and in the following, such an item such as a meat piece can be mentioned, but it will be understood that the raw material which is relevant in this connection will be an item in general, especially a foodstuff item, typically such as a piece of meat, but also other items including fish, poultry and cheese. When in the following mention is made of a piece of meat as an item, it will be understood that items other than precisely pieces of meat can apply equally as well.

Part item: to be understood as a part of the above-mentioned item which is to be cut up into slices and constitute a batch. In most cases, a part item is not physically separated from the item, but simply a result of an intermediate calculation, but it can, however, also be practised that the item/meat piece is first cut up into part items for later dividing into slices.

Slice: The smallest part into which the item is cut up.

Batch: a number of slices which are sold together, for example in a so-called fixed-weight pack.

Portion: the same as a part of a batch, possibly a whole batch.
Zone: an item can be divided into zones. Example: On a pork loin in the end closest to the neck, there is a strip of meat which is darker than the rest of the meat. When the pork loin is cut up into chops, the chops which contain a part of this strip of dark meat do not have the same attractive appearance as the others. Therefore, they must often be packed separately and sold at a lower price than those with more uniform colour. A zone border can be defined in several ways, e.g. manually (see how later) which best suits the described example, but it can also be a percentage part of the item or a certain weight or length.

Part zone: a part of a zone. Example: the rearmost part on a pork loin can be more suitable than the rest of the loin for cutting into thin slices, for example because the meat is more firm at this end).

US 5,481,466 A discloses a meat slicing machine and a method of use hereof, in particular for slicing bacon, where a bacon slab is placed in the machine, the slab is weighed and the length and width is measured using mechanical measuring means. Furthermore, the surface is scanned by means of three laser beams in order to determine the relative thickness of the slab. The density of the slab is looked up in a table containing density values as a function of the weight and the length. By means of a computer the bacon slab is divided into a number of sectional drafts having equal weights, and by means of the machine each of the drafts are cut into a predetermined number of slices, i.e. the same number of slices for each draft, which slices are cut in such a manner that the slices made from each and the same draft have essentially equal thickness, thereby making up batches that are fixed weight portions.

A similar apparatus for portioning meat for sliced packs is described in GB 2 239 787 A.
Apparently, these prior art apparatuses are arranged for slicing items into fixed weight portions that are equal in weight and that have the same number of slices. Thus, they are not suitable for handlings items that differ from each other, since e.g. the handling hereof requires readjusting and/or reprogramming of the apparatuses. Furthermore, it is not possible to produce different batches on such apparatuses and in particular it is not possible to process items that for example vary along the length of the item or vary as regards material characteristics along the length and therefore are more suitable for or even require that different batches should be produced from one and the same item.

Thus, it is an object of the invention to provide a method and a system for the cutting-up of items such as, for example, pieces of meat, that provide improvements in relation to the prior art apparatuses.

Furthermore, it is an object of the invention to provide such a method and a system that are a more flexible as regards the items that can be processed and also the options for producing different batches and/or slices.

Furthermore, it is an object of the invention to enhance the yield from the cutting-up of said items.

These and other objects are achieved by the invention as it will be explained in the following.

**Summary of the invention**

The invention relates to a method for the cutting-up of items such as, for example, pieces of meat, where an item is scanned for the determination of dimensional data of the item, where on the basis of this scanning there is determined at least one part of the item, i.e. a part-item, which fulfils a predetermined criterion as regards the weight, and
which furthermore fulfils related criteria for thickness and the number of slices into which said at least one part of the item can be cut.

Hereby, it is achieved that slices and batches can be determined that takes into account the individual parameters of the current item being processed, for example in that part items and/or batches can be produced according to a plurality of different target values.

Preferably, as specified in claim 2, there may be carried out a cutting-up into slices of said at least one part of the item, i.e. said part-item, and possibly other parts of said item, e.g. trim parts, after said determination of at least one part-item which fulfils the said criteria.

Hereby, batches of slices can be produced, which may immediately or subsequently be packaged, and possible part items that are not suitable for cutting-up into slices for a complete batch, may be handled for later use or for other types of use.

Advantageously, as specified in claim 3, there may be carried out a cutting-up into part-items after said determination of at least one part-item which fulfils said criteria, and that the selected part-item or items is/are subsequently cut into slices which fulfil the said criteria.

According to a further embodiment, as specified in claim 4, said related criteria for thickness and number of slices into which the least one part-item can be cut, may comprise that the slices are of substantially equal thickness.

Hereby, batches can be produced which fulfil e.g. customer requirements and/or requirements relating to for example equal frying times etc.

Advantageously, as specified in claim 5, the slices which are cut in the equal thickness may be packed in one package.
According to a further advantageous embodiment, as specified in claim 6, said determination and cutting-up may take place with regard being paid to one or more parameters selected from among the following:

- height of slices
- breadth of slices
- circumference of slices
- colour of surface
- manually marked place on the item/piece of meat.

Hereby, batches can be produced which fulfil further requirements and provides further options, for example as regards options for producing packages that are customer-appealing and/or are adapted for particular uses etc.

Preferably, as specified in claim 7, a cutting-up may be carried out into two or more different types of batches, and by means of control means priorities may be allotted to one or more of said types of batches, for example with regard being paid to customer orders.

Hereby, an optimal use of the raw material is achieved and furthermore the yield is optimized.

Advantageously, as specified in claim 8, one or more of said priorities may be variable with regard to parameters such as, for example, production status, capacity of machinery, etc.

Hereby, an additional flexibility is achieved that allows for an enhanced yield and optimal use of the resources.
Preferably, as specified in claim 9, use may be made of control means, so that an approximately desired production over a certain period of time is achieved, for example a production day.

According to a particular advantageous embodiment, as specified in claim 10, data relating to an identification of an item may be registered prior to the cutting-up of said item, for example prior to the scanning of said item, and whereby at least part of said data may subsequently be applied to at least said at least one part-item, e.g. slices resulting from the cutting-up, and possibly other parts, e.g. trim parts, etc.

Hereby, traceability is achieved for the produced part-items, batches etc.

Preferably, as specified in claim 11, at the cutting-up of said item in part-items, slices and/or other parts, the sequence and/or positions hereof may be registered.

Hereby, the traceability may be achieved in an efficient manner and by use of the already involved machinery.

Advantageously, as specified in claim 12, at least part of said data relating to an identification of an item may be provided in readable form, including machine-readable form, for example on a label, when parts of said item, e.g. a batch of slices, a part-item or other parts, are processed after the cutting-up, for example when a packaging takes place.

Hereby, labels stating e.g. the source of e.g. the slices of a batch and possibly further data such as e.g. the weight etc. may be readily printed and provided as the batch is being produced and possibly packaged, thereby ensuring that correct data are being related to the e.g. batches as regards origin etc.

According to a still further advantageous embodiment, as specified in claim 13, after determination of said at least one part-item, a fixing may be carried out by means of
a product or item holder immediately behind a cutting line between said part-item and a subsequent part, after which the cutting-up of the said part-item may be carried out.

5 Hereby, it is achieved that the item that is being cut up, will in essence remain in the same shape when it is being cut up as when it was scanned, i.e. the item will not be influenced by e.g. the action of the knife of the portion cutter and thus the slices will have the intended thickness.

10 Advantageously, as specified in claim 14, after the cutting-up of said at least one part item, the product or item holder may be moved to a cutting line for a subsequent part-item, after which this subsequent part-item is cut up.

Hereby, an efficient handling is achieved, that furthermore will ensure the correct cutting-up of the item.

Advantageously, as specified in claim 15, a manual marking of a characteristic criterion such as a zone border on the item may be carried out.

20 Hereby, certain characteristics of an item can be taken into account when the item is prepared for the cutting-up, for example a border between two zones that each are intended for e.g. different purposes.

Hereby, certain characteristics of an item can be taken into account when the item is prepared for the cutting-up, for example a border between two zones that each are intended for e.g. different purposes.

Preferably, as specified in claim 16, said manual marking may be carried out by the placing of the item in relation to marking on an item carrier, such as a feed-in conveyor belt.

Advantageously, as specified in claim 17, said marking may be carried out by the placing of a marking object, such as a ruler, in relation to the item, where said marking object is registered by a detector or the like.
According to a further advantageous embodiment, as specified in claim 18, said manual marking may be carried out while use is made of a light source, which is movable or where the item is moved in relation to the light source, and where a manual operation is carried out, for example by an operator, for example when the light marking passes said characteristic.

According to a particular advantageous embodiment, as specified in claim 19, slices and/or part items, e.g. trim pieces, may be held in a waiting position and may subsequently be processed, e.g. cut-up and/or used for completing a batch.

Hereby, a further optimizing of the efficiency and the yield of the process is achieved since e.g. trim pieces from different items may be used for forming a complete batch, whereby an optimal use of the raw materiel is achieved. The e.g. trim item or items may be held waiting for a suitable item from which a suitable part item may be taken for forming e.g. a complete batch of slices that fulfil the predetermined criteria.

Preferably, as specified in claim 20, said item may be scanned by means of laser vision equipment, X-ray equipment, ultrasonic equipment or similar measuring/scanning equipment.

According to a further advantageous embodiment, as specified in claim 21, the method may comprise the step that when a cutting-up of a part item is carried out and prior to the cutting of the last slice of the corresponding batch, the weight of the first cut slices may be determined and if necessary, the thickness of the last slice may be adjusted in order to achieve the desired target weight.

Hereby the accuracy of the batch can be improved, e.g. by creating a short pause before the last slice for a batch is cut, and weighing or otherwise determining the weight of the first slices before the last is cut. It will often be the case that the thickness of the last slice can be changed slightly, and thus the batch weight can be
adjusted without exceeding the thickness tolerance which is valid for the relevant slice.

According to a still further advantageous embodiment, as specified in claim 22, the method may comprise the steps that when a cutting-up of a part item is carried out, camera means arranged at the cutting arrangement, e.g. the knife, may monitor the item structure, a comparison may be performed with data produced at the scanning and adjustments of the cutting operation may be carried out if necessary.

Hereby, the accuracy of the batch can be improved, e.g. by having the camera system recognizing the item structure from the scanning time, and regularly or continuously adjusting for the errors which are registered.

According to a further preferable embodiment, as specified in claim 23, the method may comprise the steps that when a cutting-up of a part item is carried out, measuring means arranged e.g. at the cutting position, e.g. the knife, may perform a measurement of the distance between the cutting position and the trailing end of the item and adjustments of the cutting operation may be carried out if necessary.

Hereby, the accuracy of the batch can be improved, e.g. in that the measuring system regularly or continuously measures the distance between the cutting position and the second end of the item, and regularly or continuously adjusts the cutting positions so that the cuts are made at the correct distance from the other end of the item.

The invention also relates to a system for the cutting-up of items such as, for example, pieces of meat, said system comprising scanning equipment for the determination of dimensional data of an item, and said system comprising a machine, for example a portion cutter, for the cutting-up of the said items/pieces of meat, said system further comprising control means for determining at least one part of the item, i.e. a part-item, which fulfils a predetermined criterion as regards the weight,
and which furthermore fulfils related criteria for thickness and the number of slices into which said at least one part of the item can be cut.

Hereby, batches of slices can be produced, which may immediately or subsequently be packaged, and possible part items that are not suitable for cutting-up into slices for a complete batch, may be handled for later use or for other types of use.

Advantageously, as specified in claim 25, said system may be adapted for cutting-up said items into two or more different types of batches, and by means of control means priorities may be allotted to one or more of said types of batches, for example with regard being paid to customer orders.

Hereby, an optimal use of the raw material is achieved and furthermore the yield is optimized.

Preferably, as specified in claim 26, one or more of said priorities may be variable with regard to parameters such as, for example, production status, capacity of machinery, etc.

Hereby, an additional flexibility is achieved that allows for an enhanced yield and optimal use of the resources.

According to a further advantageous embodiment, as specified in claim 27, said system may comprise means for registering data relating to an identification of an item prior to the cutting-up of said item, for example prior to the scanning of said item, and means for subsequently allocating at least part of said data to at least said at least one part-item, e.g. slices resulting from the cutting-up, and possibly other parts, e.g. trim parts, etc.

Hereby, traceability is achieved for the produced part-items, batches etc.
Preferably, as specified in claim 28, at the cutting-up of said item in part-items, slices and/or other parts, the sequence and/or positions hereof may be registered by said control means.

Hereby, the traceability may be achieved in an efficient manner and by use of the already involved machinery.

According to a still further advantageous embodiment, as specified in claim 29, said system may comprise means for supplying at least part of said data relating to an identification of an item in readable form, including machine-readable form, for example on a label, when parts of said item, e.g. a batch of slices, a part-item or other parts, are processed after the cutting-up, for example when a packaging takes place.

Hereby, labels stating e.g. the source of e.g. the slices of a batch and possibly further data such as e.g. the weight etc. may be readily printed and provided as the batch is being produced and possibly packaged, thereby ensuring that correct data are being related to the e.g. batches as regards origin etc.

According to a further preferable embodiment, as specified in claim 30, said system may comprise a product or item holder for fixing said part item.

Hereby, it is achieved that the item that is being cut up, will in essence remain in the same shape when it is being cut up as when it was scanned, i.e. the item will not be influenced by e.g. the action of the knife of the portion cutter and thus the slices will have the intended thickness.

Advantageously, as specified in claim 31, said system may comprise means for performing a manual marking of a characteristic criterion such as a zone border on the item.
Hereby, certain characteristics of an item can be taken into account when the item is prepared for the cutting-up, for example a border between two zones that each are intended for e.g. different purposes.

Advantageously, as specified in claim 32, said means for performing a manual marking may comprise a marking on an item carrier, such as a feed-in conveyor belt.

Preferably, as specified in claim 33, said means for performing a manual marking may comprise a marking object, such as a ruler, to be placed in relation to the item, and a detector or the like for registering said marking object.

Advantageously, as specified in claim 34, said means for performing a manual marking may comprise a light source, which is movable or where the item is moved in relation to the light source, and where said system may comprise input means, e.g. a manually operated input means, for indicating when the light marking passes said characteristic.

According to a further preferable embodiment, as specified in claim 35, said system may comprise means for accommodating slices and/or part items, e.g. trim pieces that are held in a waiting position for e.g. subsequent processing, e.g. cutting-up and/or use for completing a batch.

Hereby, a further optimizing of the efficiency and the yield of the production process performed by the system is achieved since e.g. trim pieces from different items may be used for forming a complete batch, whereby an optimal use of the raw materiel is achieved. The e.g. trim item or items may be held waiting for a suitable item from which a suitable part item may be taken for forming e.g. a complete batch of slices that fulfil the predetermined criteria.
Advantageously, as specified in claim 36, said system may comprise scanning means in the form of laser vision equipment, X-ray equipment, ultrasonic equipment or similar measuring/scanning equipment.

According to a further preferable embodiment, as specified in claim 37, said system may be adapted for performing a determination of the weight of the first cut slices of a batch, when a cutting-up of a part item is carried out, prior to the cutting of the last slice of said batch, and for adjusting the thickness of the last slice in order to achieve the desired target weight if necessary.

Hereby the accuracy of the batch can be improved, e.g. by creating a short pause before the last slice for a batch is cut, and weighing or otherwise determining the weight of the first slices before the last is cut. It will often be the case that the thickness of the last slice can be changed slightly, and thus the batch weight can be adjusted without exceeding the thickness tolerance which is valid for the relevant slice.

According to a still further preferable embodiment, as specified in claim 38, said system may comprise camera means arranged at the cutting arrangement, e.g. the knife, said camera means being arranged for monitoring the item structure during the cutting-up of an item, means for performing a a comparison with data produced at the scanning and means for adjusting the cutting operation on the basis of said comparison if necessary.

Hereby, the accuracy of the batch can be improved, e.g. by having the camera system recognizing the item structure from the scanning time, and regularly or continuously adjusting for the errors which are registered.

According to an even further preferable embodiment, as specified in claim 39, said system may comprise measuring means arranged e.g. at the cutting position, e.g. the knife, for performing a measurement of the distance between the cutting position and
the trailing end of the item and means for adjusting the cutting operation on the basis of said measurement if necessary.

Hereby, the accuracy of the batch can be improved, e.g. in that the measuring system regularly or continuously measures the distance between the cutting position and the second end of the item, and regularly or continuously adjusts the cutting positions so that the cuts are made at the correct distance from the other end of the item.

The figures

The invention will be explained in further detail below with reference to the figures of which

Fig. 1 shows in a schematic manner a system according to an embodiment of the invention seen from above,

Fig. 2 shows in a schematic manner an example of the dividing of an item into zones,

Fig. 3 shows further examples of the dividing of an item into zones or part-items and a subsequent cutting-up into slices according to an embodiment of the invention,

Fig. 4 illustrates an arrangement for fixing an item according to a further aspect of the invention,

Figs. 5a-5c illustrate in accordance with further aspects of the invention arrangements for indicating a characteristic of an item,

Fig. 6 shows a block diagram of a further embodiment of a system according to the invention,

Fig. 7 shows in a perspective view the main components of a portion cutter for use in connection with an embodiment of the invention, and

Figs. 8 and 9 show graphs illustrating an example of the measurements performed by a portion cutter.
Detailed description

In fig. 1 there is shown an example of a portion cutter indicated in general by the reference number 1, and which for example can be used in connection with the invention. The items to be cut, for example pieces of meat 10, are transported on a conveyor belt 2 forward to the machine where the piece of meat is first scanned 4, for example by means of laser vision equipment, X-ray equipment, ultrasonic equipment or similar measuring/scanning equipment. On the basis of this scanning, a number of pieces which fulfil certain criteria is determined, as will be explained in more detail in the following, and a cutting-up, e.g. at the location 6, of the piece of meat 10 into batches 12 of slices and possibly trim pieces is carried out. As mentioned, this cutting-up is carried out for example with a rotating knife or the like, as will also be described in more detail later. As shown, the batches 12 and possible trim pieces etc. may be transported away from the portion cutter 1 by means of a conveyor belt 8.

Further transport means 14 may be used for e.g. supplying package means 16, e.g. trays, and/or for transporting batches 12 that has been transferred to package means 16.

As shown in fig. 2, an item, e.g. a piece of meat 10, can comprise several zones 10a-10c, which can preferably be used for special cuts. The zone 10a can thus be particularly suitable for thin slices, the zone 10b for thicker slices, and the zone 10c can be suitable for special purposes.

The preferred embodiment is best described with an example:

As the first priority of part-zone 1, the portion cutter is programmed to cut a batch of 500 g consisting of 5, 6 or 7 slices with the same thickness of between 10 and 12 mm. If this cannot be done, as the second priority of part-zone 1 in zone 1 the portion cutter is then programmed to cut a batch of 500 g consisting of 6, 7 or 8 slices with the same thickness of between 9 and 11 mm. If this cannot be done either, as third priority of part-zone 1 in zone 1 the portion cutter is programmed to cut a slice of
150 g and try again from the start (with part-zone 1 priority 1). The portion cutter can, for example, be programmed to cut a maximum of two slices of 150 g before it completely abandons the cutting of a part-zone 1 batch of zone 1. In order for these single slices to be easy to identify, they can come out of the machine as a batch of one slice, that is with relatively large distance to both sides.

Thereafter, the portion cutter is programmed to cut that number of part-zone 2 batches in zone 1 which is permitted by the length of zone 1. Correspondingly, there can be several priorities of cutting programmes for part-zone 2 as there are described for part-zone 1.

In a completely corresponding manner, there can be several priorities and part-zones in zone 2.

The border between zone 1 and zone 2 can be marked manually, e.g. by the operator placing a marker at the relevant place on top of the item. This marker is configured so that it follows with the item to a place where it is stopped by a switch, which it activates. When the switch is activated, this is registered by the control unit, and in this manner the place on the conveyor belt where the border between zone 1 and zone 2 lies is defined. The marker is provided with a friction arrangement so that the item can continue undisturbed, and so that it can remain at the relevant place until the operator moves it over to the border on the subsequent item.

It can also be programmed how the portion cutter is to consider the border, i.e. whether it shall produce the batch that consists partly of zone 1 and partly of zone 2 slices, according to a zone 1 programme or according to a zone 2 programme.

When it is prescribed that the portion cutter is to cut slices of uniform thickness, this will naturally only be approximate, since there will always be a certain degree of inaccuracy.
However, the machine can be programmed to pay a certain regard concerning the weight of the slices, so that if it is estimated that slices of 20 mm shall have the same frying time as slices of 21 mm, the slices in a batch can knowingly be allowed to vary between 20 and 21 mm in order to ensure that they are more uniform in weight than they would be otherwise.

The individual slices which in the above example are cut to 150 g can e.g. be packed together manually in batches of e.g. 600 g. This can be done in several ways, the simplest of which is to do it manually and control the batch weight on a non-automatic weighing machine or an automatic weighing machine, e.g. a check-weigher. Furthermore, the batches can be packed automatically, for example transferred automatically to package means 16, cf. fig. 1, and afterwards the batch weight can be controlled, for example by means of an automatic weighing machine, e.g. a check-weigher.

The traceability of the origin of the individual batch will be easiest for the batches cut from an item. The items supplied are often packed and provided with electronically readable data, e.g. labels with bar codes, which state e.g. the origin. They are unpacked in front of the portion cutter and the origin data is read into the control unit, possibly automatically. On the outlet side of the portion cutter, the batches thus come out in a known sequence, and the control unit has full control of the time delay and therefore it is simple matter to state the origin of each batch. Consequently, if a tray on a tray conveyor belt running parallel with the item conveyor belt, for example as shown in fig. 1, (and at the same speed) is released for each batch, and the batches are moved (possibly manually) to the trays without relative movement of the trays, after which the trays are provided with lids, the traceability is maintained. Therefore, a label can be applied to the tray after it has been provided with a lid.
As described, the items are often packed because the pieces of meat involved are matured. Other items which come directly from an earlier process will also be known with regard to traceability when they reach forward to the portion cutter.

The traceability of the individual slices which in the above example are cut to 150 g is more difficult to maintain. It can be done, however, in the same manner as described above, but most often it will probably be implemented at consignment level, i.e. on time basis, and the control unit shall thus register which items are cut within a period of time, and the traceability data on the batches which are composed from such slices shall thus be marked with a consignment number. The consignments will be larger or smaller depending on the manner it is arranged in detail.

It will be understood that the above is only one possibility among many. A modern portion cutter can be provided with a large number of programmes, all user-defined and even computer supported, so that the operator does not come to make any unintentional errors.

In that the slices which form one and the same batch will preferably be cut from a coherent part-item, so-called "sister chops", the individual slices will be uniform, for example with regard to size (height, breadth and/or shape) quality, colour etc., whereby also the packed portion of slices will create a favourable impression e.g. among the consumers.

In the following there are mentioned several other parameters which can be involved in the cutting-up.

According to the invention, the determination of the said part items and the cutting-up can be carried out with regard being paid to one or more parameters selected from among the following:

- height of slices
- breadth of slices
- circumference of slices
- shape of slices
- surface colour
- manually marked place on the item.

It will be obvious, however, that other parameters can be taken into consideration.

The dividing into part-items and the immediately subsequent or later cutting-up into slices is illustrated further in fig. 3.

Uppermost there is shown "Option 1", where a single piece of meat (Loin 1) is divided into four part-items, three of which (Batch 1—Batch 3) fulfil the weight criterion regarding a total weight of, for example, 500 g. The fourth part-item (Trim) does not fulfil the weight criterion and can be used for other purposes such as explained in the next section. As will be seen, all of the part-items Batch 1-3 are cut into a number of slices - in this example five slices - and these slices will be of substantially the same thickness, possibly within certain tolerances. But it will be obvious that where slices e.g. in Batch 1 are approx. 19 mm thick, the slices in Batch 2 can e.g. be 21 mm thick, and the slices in Batch 3 ca be e.g. 20.5 mm thick, so that all of the slices meet the requirements concerning a thickness of e.g. 20 mm +/- 2 mm. In this connection it shall be mentioned that the cutting-up of the part-items Batch 1-3 in the shown example into precisely five slices each is coincidental, that the number of slices can vary from part-item to part-item, and that naturally there can be more or fewer than five slices in each.

As mentioned, the fourth part-item (Trim) can be used for other purposes or can be "parked" in a position where it is held awaiting the arrival of a piece of meat with the same characteristics, and where the part-item/trim piece can be used for cutting into slices so that it forms a batch together with slices from this other piece of meat.

In determining where the fourth part-item shall be taken from the item, providing that there is the possibility of several positions for this in the item's longitudinal
direction, regard can be paid to various data, such as knowledge concerning shape, size, height/breadth etc. of the items, this knowledge being obtained e.g. by measurements, scanning etc. of (preceeding) items, or in other ways. It can thus be selected to take this part-item at a place which is of such a character that there will be great probability that this fourth part-item can relatively quickly be placed together with part-items from other (subsequent) items, for example meat pieces, e.g. with an end piece of a subsequent item, e.g. meat piece, and such that the conditions defined for this batch are achieved.

In "Option 2" there is shown substantially the same division as in "Option 1", but where the division has been made so that the trim piece appears at the end of the item.

In "Option 3" it is also shown how this trim piece/part-item can be used together with a subsequent item, e.g. meat piece (Loin 2), in the production of a portion with a total weight of e.g. 500 g, but where there will thus be a certain difference in size (height, breadth and/or shape), but where cutting takes place at the same thickness. As will be seen, in this last portion there will be a total of six slices, but it will be obvious that any other number of slices can arise, depending of the actual conditions.

It will be obvious that the trim piece or trim pieces can be transported out to a waiting position, where it is held awaiting the arrival of an item which has substantially the same characteristics.

Fig. 4 illustrates a further aspect in connection with an embodiment of the invention, whereby other means are taken into use to ensure the maintaining of the total weight for the slices which are cut from a selected part-item, which e.g. are selected so that they have a total weight of 500 g. As shown, use can be made of a portion cutter, where a knife or the like, which is shown schematically at 20, cuts the individual slices between two conveyor belts 22 and 24, gradually as the item 10 is moved forwards. It will be understood that in the cutting process a certain deviation can
arise in relation to the ideal, pre-selected cutting line 30 between the individual slices, e.g. by movement of the meat or deformation under influence of the knife 30. To ensure that such deviations will not have influence on the cutting-up at the ideal cutting line 26 between two part-items, and herewith the desired "target weight", a fixing of the item by means of a product holder 32 can be effected before the cutting of a specific part-item. This product holder 32, which e.g. has one, two or more pointed prongs 34, e.g. in the form of a fork or the like, can be moved up and down and be positioned before the cutting-up commences immediately at the rear at the cutting line 26 between that part-item which is actually to be cut, and the subsequent part-item, such as shown in fig. 4. This product holder 32 is moved forwards together with the belt 24 and the item 10, and when the last slice has been cut from the relevant part-item at the line 26, the product holder 32 is raised and led back to a position at the cutting line 28 between the two subsequent part-items, and lowered so that the prongs 34 are placed immediately behind this next cutting line, after which the sequence is repeated.

A second method by which the accuracy of the batch can be improved is to create a short pause before the last slice for a batch is cut, and weigh the first slices before the last is cut. It will often be the case that the thickness of the last slice can be changed slightly, and thus the batch weight can be adjusted without exceeding the thickness tolerance which is valid for the relevant slice.

A third method for improving the accuracy of the batch is to arrange a camera system at the knife and recognize the item structure from the scanning time, and regularly or continuously adjust for the errors which are registered.

A fourth method for improving the accuracy of the batch is to arrange a measuring system at the knife and regularly or continuously measure the distance between the cutting position and the second end of the item, and regularly or continuously adjust the cutting positions so that the cuts are made at the correct distance from the other end of the item.
A further aspect of an embodiment of the invention will be described in connection with figs. 5a - 5c, where there are shown different examples of how with a manual feeding of the items, for example pieces of meat to a machine according to the invention, e.g. a portion cutter as illustrated in fig. 1, at the same time there can be given an indication to the system regarding a certain characteristic criterion for the individual item, e.g. the individual piece of meat, so that in a simple manner the system is informed and the positioning of this characteristic criterion can be taken into consideration together with other parameters which, e.g., are obtained by the scanning of the item. Such a characteristic can, for example, be the borderline between different zones as shown in fig. 2, which e.g. can be used for different purposes and/or has different shapes, colours and/or other characteristics.

As shown in fig. 5a, on the feeding conveyor belt 2 there can be a marking 42 which extends transversely across the belt, and where an operator thus seeks to place the piece of meat 10 in such a way that the relevant characteristic 40, e.g. the borderline between two zones, coincides with the marking 42. In connection with the conveyor belt 2, e.g. on the underside as indicated, there can be placed an element 44 which can cooperate with a fixedly-mounted sensor 46, so that the system detects when the element 44 passes the sensor 46, whereby the system is provided with information concerning the positioning of the said characteristic 40. It is obvious that use can be made of many different types of sensors 46 and elements 44, such as magnetic, electromagnetic, optical, mechanical etc.

Fig. 5b shows a further embodiment, where after having placed the item 10 on the belt 2, the operator places a ruler 48 or the like at the said characteristic 40. This ruler 48 is moved together with the item 10 and the belt 2 until it abuts up against or passes a stop 50, detector or the like, whereby the system registers the position.

As shown in fig. 5c, with a further embodiment use can be made of a ray of light, by means of which the operator can indicate the position of the said characteristic 40. A
light source 52, e.g. a laser beam, can thus be arranged to be moved, e.g. turned or displaced laterally in relation to the machine 1. When the ray of light hits said characteristic 40, which is observed by the operator, a switch or the like 56 is activated so that the system is informed of the positioning.

Instead of a light source 52 which is movable, a ray of light can be mounted in a fixed manner and directed down towards the belt 2. When the item 10 is moved forward towards the cutter 1, said characteristic 40 will pass the ray of light 54 at a time which is observed by the operator, who at this time activates the switch 56 for indication of the position.

In the following, a further aspect in connection with the invention will be explained in more detail with reference to fig. 6, which schematically shows a system for the execution of the invention.

There is thus seen a portion cutter 1 which is fed with a flow of products, for example pieces of meat 10, which are cut up as discussed in the above. The resulting batches 12 are fed further, e.g. to a packing machine 60, from where the resulting packages 70 are transported away. As mentioned, the cutting-up of the items can be effected to produce different cuts. These cuts of meat can also be identified in different ways when packaged, and use can be made of different packaging machines, e.g. 60, 62, 64 and 66, each of which packs different types of batches 70, 72, 74 and 76.

By means of the invention, one can scan e.g. a pork loin, whereby it can be ascertained how it can be cut up in the optimum manner with regard to e.g. 4-5 different possibilities. In the following, these possibilities are referred to as programmes. Each of these programmes can, however, contain information regarding order amounts, possibly tied up with specific customers. Consequently, it is important to know the extent to which a programme is to be used. Since the programmes overlap one another, there is a need to indicate to the portion
cutter/cutters which of the programmes it/they shall give priority to as being the most important or more important in relation to the others.

For example, it can be envisaged that a customer has placed an order for the production of the following batches:

Batch 1: Regulars 4000 batches @ 1 kg = 4000 kg
Batch 2: Thins 5000 batches @ 1 kg = 5000 kg
Batch 3: Centre cuts 2500 batches @ 1 kg = 2500 kg
Batch 4: Butterflies 1500 batches @ 1 kg = 1500 kg
Batch 5: Assorted 1500 batches @ 1 kg = 1500 kg

It is incidental in this example that 1 kg has been chosen for each batch. It is obvious that the batches can be of other amounts and differ from one another.

As shown, the portion cutter is associated with a control unit 58, for example computer control, which as input can receive information concerning customers' orders, programmes etc., after which the control ensures that a distribution is made such as desired or approximately as desired.

A desired distribution into different batches can thus be achieved by each of the batch types being given different priorities (p1, p2, p3, p4, p5) by the control system 58.

This allotting of priorities can be changed dynamically during operations. For example, during operations it can prove that due to the type, the quality etc. of the items being cut, for example pieces of meat 10, a higher yield can be achieved with a programme other than that being used, and thus this type of cutting-up is given a lower priority during operations. Something similar can be envisaged with regard to customer requirements.
Moreover, it can be envisaged that a packing machine 60 - 66 on the line breaks down, for example a packing machine which packs "thins", and thus it can be desirable for this product to be given the lowest priority from the one moment to the next. When the machine has been repaired, the system can let the relevant product be given a higher priority again.

In the same manner, it is desirable that a limitation can be introduced into the system, so that e.g. 60 batches per minute of "thins" is not produced if the relevant packing machine has a maximum capacity of 45 trays or batches per minute.

Moreover, as shown with the dotted lines, several portion cutters e.g. 1' and 1" can be connected to the system, said portion cutters carrying out cutting for the same order or orders as cutter 1, and which send batches to the same packing machines as the first-mentioned portion cutter. These portion cutters can also be connected to the same main control system 58, such as shown.

The total order amount prevailing at any given time of the day, together with the production status which is valid at any given time, is an important control parameter. There is thus a need, as mentioned, for a changing of the priorities, depending on how far operations have reached in producing the amounts to be made with the different programmes.

The object of this aspect of the invention is thus to effect the production in such a manner that - at the end of the day - the correct amount of each product has been produced.

As mentioned, the problem of control will increase when several portion cutters are working on the above-mentioned orders simultaneously, which as mentioned is also solved by means of the invention.
Finally it can be mentioned that the execution of orders does not necessarily need to be precise, but can be approximate, so that the finished orders do not need to be in exact accordance with the desired total weight.

In the following, a portion cutter will be described in more detail, and it will be explained how it functions with reference to fig. 7.

Examples of such systems are described in e.g. WO 2004/034794, WO 01/32369, Danish Utility Model Registration no. DK 9600164 U and EP 504466 Al.

A simplification of the machine can be seen in fig. 7, where

101 is an item to be cut up.
102 is the light source (first part of the scanning system)
103 is the camera (second part of the scanning system)
104 is the ray of light which is emitted from the light source and directed onto the item and which the camera scans (when it is scanned at an inclined angle as shown, the height can be calculated)
105 is the knife
106 is the cut-up items, called "slices"

The work process is that the item is laid on the first conveyor. This leads the item under the scanning system. Here, the item is measured electronically, and an accumulated volume-curve of the item is registered with starting point from the first end of the item. This can easily be effected when the speed of the conveyor is known. The speed of the conveyor is known either because it is measured with equipment associated herewith or because it is controlled electronically.

The relationship between weight and volume must be known. If it is not known, a weighing machine can be placed in front of the portion cutter and the items are weighed one by one before being fed into the portion cutter. Since the meat involved over a longer working period is most often of the same kind, it can suffice to carry...
out a "calibration" from time to time, so that ordinarily the weight/volume ratio is considered to be known.

When the control unit has registered the volume curve and the weight/volume ratio is known, the next step is to convert the volume curve to a weight curve, still with the starting point from the first end of the item. When the prescribed weight curve has been obtained, the cutting positions are calculated (for the desired size of slices), such as the distance from the first end of the item. Since the speed of the conveyor is known, and the distance from the scanning system to the knife is known, it is now possible to calculate where the knife shall cut through the item in order to produce precisely the size of slices the item is desired to be divided into.

The graphs shown in figs. 8 and 9 show the results of the mentioned first measurements, i.e. first the cross section as a function of the distance from the first end of the item as shown in fig. 8, and thereafter the accumulated weight of the item as a function of the distance from the first end of the item as shown in fig. 9. As will further be seen, it is easy to determine the cutting positions. For example, it is shown that the cutting positions for 200 g slices are 73, 108, 138, 164, 189, 214, 240, 268, 300 and 343 mm respectively from the first end of the item. The item is 400 mm long and weighs 2092 g. There is thus remaining a piece of 57 mm and 92 g, a so-called trim piece.

Correspondingly, if four slices for a batch of 600 g are to be cut, it will be seen that the first batch shall be 138 mm long. If it is to be divided into four equally thick slices, they shall each thus be 34.5 mm thick. The next batch must be 76 mm (214 - 138 mm), which means that the slices here are each of 19 mm. The third batch accordingly 86 mm corresponding to four slices of 21.5 mm.

As will be seen, the item is shown very thin at the ends in order to better illustrate the function. In reality, the items which are cut into slices have a more uniform thickness, so that the individual slices are more uniform. It will also be understood
that the machine can carry out the cutting so that trim pieces are cut from both ends, whereby the single slices become more uniform than they would be otherwise. Similarly, it will be understood that it is an advantage to measure the whole item before the cutting-up commences, so that it can be chosen how the item can best be utilised. Therefore, there is typically so great a distance between the scanning system and the knife that the whole of the item can lie there. Typically, the conveyor belts are not stopped during the process itself— all operations take place while they are running.

It shall be mentioned that the scanning function can be improved by supplementing or replacing the said light source with a laser emitter, x-ray equipment, ultrasonic or similar/corresponding measuring/scanning equipment. In this manner it is possible to extend the function to pay regard to e.g. quality, colour, fat marbling etc.

It shall furthermore be mentioned that as shown in fig. 1, trays 16 or similar packing can be transported to the machine via a separate conveyor 14, so that an operator can transfer the individual batches 12 to their individual trays 16.
Patent claims

1. Method for the cutting-up of items such as, for example, pieces of meat, where an item is scanned for the determination of dimensional data of the item, where on the basis of this scanning there is determined at least one part of the item, i.e. a part-item, which fulfils a predetermined criterion as regards the weight, and which furthermore fulfils related criteria for thickness and the number of slices into which said at least one part of the item can be cut.

2. Method according to claim 1, characterised in that there is carried out a cutting-up into slices of said at least one part of the item, i.e. said part-item, and possibly other parts of said item, e.g. trim parts, after said determination of at least one part-item which fulfils the said criteria.

3. Method according to claim 1, characterised in that there is carried out a cutting-up into part-items after said determination of at least one part-item which fulfils said criteria, and that the selected part-item or items is/are subsequently cut into slices which fulfil the said criteria.

4. Method according to one or more of claims 1-3, characterised in that said related criteria for thickness and number of slices into which the least one part-item can be cut comprise that the slices are of substantially equal thickness.

5. Method according to one or more of claims 1—4, characterised in that the slices which are cut in the equal thickness are packed in one package.

6. Method according to one or more of claims 1-5, characterised in that said determination and cutting-up takes place with regard being paid to one or more parameters selected from among the following:

- height of slices
- breadth of slices
7. Method according to one or more of claims 1-6, characterised in that a cutting-up is carried out into two or more different types of batches, and that by means of control means priorities (p1, p2, p3, p4, p5) are allotted to one or more of said types of batches, for example with regard being paid to customer orders.

8. Method according to claim 7, characterised in that one or more of the said priorities (p1, p2, p3, p4, p5) is/are variable with regard to parameters such as, for example, production status, capacity of machinery, etc.

9. Method according to claim 7 or 8, characterised in that use is made of control means, so that an approximately desired production over a certain period of time is achieved, for example a production day.

10. Method according to one or more of claims 1-9, characterised in that data relating to an identification of an item is registered prior to the cutting-up of said item, for example prior to the scanning of said item, and whereby at least part of said data is subsequently applied to at least said at least one part-item, e.g. slices resulting from the cutting-up, and possibly other parts, e.g. trim parts, etc.

11. Method according to claim 10, characterised in that at the cutting-up of said item in part-items, slices and/or other parts, the sequence and/or positions hereof is/are registered.

12. Method according to claim 10 or 11, characterised in that at least part of said data relating to an identification of an item is provided in readable form, including machine-readable form, for example on a label, when parts of said item,
e.g. a batch of slices, a part-item or other parts, are processed after the cutting-up, for example when a packaging takes place.

13. Method according to one or more of claims 1 - 12, characterised in that after determination of said at least one part-item, a fixing is carried out by means of a product or item holder immediately behind a cutting line (26) between said part-item and a subsequent part, after which the cutting-up of the said part-item is carried out.

14. Method according to claim 13, characterised in that after the cutting-up of said at least one part item, the product or item holder (32) is moved to a cutting line (28) for a subsequent part-item, after which this subsequent part-item is cut up.

15. Method according to one or more of claims 1 - 14, characterised in that a manual marking of a characteristic criterion such as a zone border on the item is carried out.

16. Method according to claim 15, characterised in that said manual marking is carried out by the placing of the item (10) in relation to marking (42) on an item carrier, such as a feed-in conveyor belt (2).

17. Method according to claim 15, characterised in that said marking is carried out by the placing of a marking object (48), such as a ruler, in relation to the item (10), where said marking object (48) is registered by a detector (50) or the like.

18. Method according to claim 15, characterised in that said manual marking is carried out while use is made of a light source (52), which is movable or where the item (10) is moved in relation to the light source, and where a manual operation is carried out, for example by an operator, for example when the light marking passes said characteristic.
19. Method according to one or more of claims 1 - 18, characterised in that slices and/or part items, e.g. trim pieces, can be held in a waiting position and subsequently be processed, e.g. cut-up and/or used for completing a batch.

20. Method according to one or more of claims 1 - 19, characterised in that said item is scanned by means of laser vision equipment, X-ray equipment, ultrasonic equipment or similar measuring/scanning equipment.

21. Method according to one or more of claims 1 - 20, characterised in that when a cutting-up of a part item is carried out and prior to the cutting of the last slice of the corresponding batch, the weight of the first cut slices is determined and if necessary, the thickness of the last slice is adjusted in order to achieve the desired target weight.

22. Method according to one or more of claims 1 - 20, characterised in that when a cutting-up of a part item is carried out, camera means arranged at the cutting arrangement, e.g. the knife, monitors the item structure, a comparison is performed with data produced at the scanning and adjustment of the cutting operation is carried out if necessary.

23. Method according to one or more of claims 1 - 20, characterised in that when a cutting-up of a part item is carried out, measuring means arranged e.g. at the cutting position, e.g. the knife, performs a measurement of the distance between the cutting position and the trailing end of the item and adjustment of the cutting operation is carried out if necessary.

24. System for the cutting-up of items such as, for example, pieces of meat, said system comprising scanning equipment for the determination of dimensional data of an item, and said system comprising a machine, for example a portion cutter, for the cutting-up of the said items/pieces of meat, said system further comprising control means for determining at least one part of the item, i.e. a part-item, which fulfils a
predetermined criterion as regards the weight, and which furthermore fulfils related criteria for thickness and the number of slices into which said at least one part of the item can be cut.

25. System according to claim 24, characterised in that said system is adapted for cutting-up said items into two or more different types of batches, and that by means of control means priorities (pl, p2, p3, p4, p5) are allotted to one or more of said types of batches, for example with regard being paid to customer orders.

26. System according to claim 25, characterised in that one or more of the said priorities (pl, p2, p3, p4, p5) is/are variable with regard to parameters such as, for example, production status, capacity of machinery, etc.

27. System according to claim 24, 25 or 26, characterised in that said system comprises means for registering data relating to an identification of an item prior to the cutting-up of said item, for example prior to the scanning of said item, and means for subsequently allocating at least part of said data to at least said at least one part-item, e.g. slices resulting from the cutting-up, and possibly other parts, e.g. trim parts, etc.

28. System according to claim 27, characterised in that at the cutting-up of said item in part-items, slices and/or other parts, the sequence and/or positions hereof is/are registered by said control means.

29. System according to claim 27 or 28, characterised in that said system comprises means for supplying at least part of said data relating to an identification of an item in readable form, including machine-readable form, for example on a label, when parts of said item, e.g. a batch of slices, a part-item or other parts, are processed after the cutting-up, for example when a packaging takes place.
30. System according to one or more of claims 24 - 29, characterized in that said system comprises a product or item holder (32) for fixing said part item.

31. System according to one or more of claims 24 - 30, characterized in that said system comprises means for performing a manual marking of a characteristic criterion such as a zone border on the item.

32. System according to claim 31, characterized in that said means for performing a manual marking comprises a marking (42) on an item carrier, such as a feed-in conveyor belt (2).

33. System according to claim 31, characterized in that said means for performing a manual marking comprises a marking object (48), such as a ruler, to be placed in relation to the item (10), and a detector (50) or the like for registering said marking object (48).

34. System according to claim 31, characterized in that said means for performing a manual marking comprises a light source (52), which is movable or where the item (10) is moved in relation to the light source, and where said system comprises input means, e.g. a manually operated input means, for indicating when the light marking passes said characteristic.

35. System according to one or more of claims 24 - 34, characterized in that said system comprises means for accommodating slices and/or part items, e.g. trim pieces that are held in a waiting position for e.g. subsequent processing, e.g. cutting-up and/or use for completing a batch.

36. System according to one or more of claims 24 - 35, characterized in that said system comprises scanning means in the form of laser vision equipment, X-ray equipment, ultrasonic equipment or similar measuring/scanning equipment.
37. System according to one or more of claims 24 - 36, characterised in that said system is adapted for performing a determination of the weight of the first cut slices of a batch, when a cutting-up of a part item is carried out, prior to the cutting of the last slice of said batch, and for adjusting the thickness of the last slice in order to achieve the desired target weight if necessary.

38. System according to one or more of claims 24 - 36, characterised in that said system comprises camera means arranged at the cutting arrangement, e.g. the knife, said camera means being arranged for monitoring the item structure during the cutting-up of an item, means for performing a comparison with data produced at the scanning and means for adjusting the cutting operation on the basis of said comparison if necessary.

39. System according to one or more of claims 24 - 36, characterised in that said system comprises measuring means arranged e.g. at the cutting position, e.g. the knife, for performing a measurement of the distance between the cutting position and the trailing end of the item and means for adjusting the cutting operation on the basis of said measurement if necessary.
Fig. 4
Fig. 6