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Method for feeding farm animals

The present invention relates to a method for feeding farm animals with feed that is mixed and/or prepared in a feeding system in which a feed quantity recording operation takes place and from there is transported to at least one feeding place, with a composition of the feed being predefined via an EDP system on the basis of relevant components for feeding the farm animals, in particular with respect to protein, energy and/or fibre content, and with the weight of the farm animals being determined by means of a weighing unit and/or the EDP system. The weight increase of the farm animals is determined in the at least one weighing unit and/or in the EDP system, whereupon a feed composition adapted to the farm animals is determined in the EDP system on an automated basis, in particular daily, and the feed provided to the farm animals is adapted.

Modern mixed feed recommendations are based on the scientifically-researched requirements, in particular for proteins and energy quantities for each animal depending on the respective body mass and the daily increases of the farm animals. For example, the farm animals may be pigs, which are held in a large group of more than 100 up to 300 animals. For the respective genetics, there are absolute requirement values for proteins, amino acids and energy in the case of the individual pigs based on table values. Based on estimates of the body mass and the feeding quantities or feed intake quantity, percentage proportions of raw proteins in the feed and the required energy density of the feed emerge. In the associated EDP system, the composition of the feed is predefined on the basis of the components, with the averaged weights of the animals being

determined via a weighing unit. The feed quantity consumed by the farm animals in total over an extended time period is also in part determined. Even though nowadays the fattening pigs on a farm have an identical origin mainly over a long period, the relevant parameters for optimal feed composition vary significantly (feed intake, weight, growth).

Methods for feeding farm animals with quantities and/or compositions adapted to the nutritional requirements of the respective animal are known from the prior art.

EP 1 250 839 shows a feed device for farm animals in which the respective animal is identified at the feeding place and feed is delivered corresponding to the animal. A determined feed quantity is made available to the animal in this case.

WO 00/21359 shows a feeding method to automatically feed farm animals in which the feed quantity is adapted to the individual nutritional requirements of the animals and the feed is yielded by a milking machine.

WO 2015/160241 shows a feeding device, in which both at the feeding place and at the drinking place, the respective animal is identified and, in addition to the delivery of feed at the feeding place, feed concentrate is also added to the drinking water in order to ensure sufficient nutritive intake of the farm animals. This concerns a supplementary feeding of concentrated nutrients.

WO 2009/090250 shows a feeding system for an individualised or groupwise ad libitum feeding of farm animals.

US 6,539,896 shows a feeding device for automated feeding of farm animals with a feeding carousel which has a number of individual feeding regions. The entrance to the feeding carousel is accessed via a gate in which the individual farm animals are identified and weighed. A farm animal can optionally be assigned by the gate to a separate enclosure.

The object of the present invention is to design a feeding method according to the preamble which can be carried out in a simplified manner.

The object is achieved by a method according to claim 1 and by a device according to claim 8. Advantageous configurations of the invention can be inferred from the dependent claims referring back to these claims and from the following description.

According to the invention, this object is achieved by a method with which the farm animals are fed ad libitum and by means of the feeding system and/or the EDP system the feed quantity consumed by the farm animals is determined. The feed composition is determined in the EDP system, i.e. by a program running in the working memory of this EDP system, in particular depending on at least the current weight increase and the current feed quantity intake of the farm animal(s). It lends itself to use for example a number of different mathematical functions to determine the composition depending on the respective recommendations for the feeding of the farm animals. The farm animals are divided into groups by clustering the individual feed compositions of individual animals or of individual groups of farm animals already selected beforehand.

One of a plurality of spatially separate feeding places provided with differently composed feed is made available to the respective farm animal via at least one sorting gate depending on group membership. Thus, for example, at least two, preferably at least three feeding places can be made available for the respective group of animals.

A fluctuating state of health or even climatic influences such as for example heat in the summer lead to differences in the feed intake of the individual animals.

In the case of ad libitum feeding, which is generally preferred for the welfare of the animal, these differences for example lead to the actual feed intake being underestimated. The quantity of protein consumed with the feed then exceeds the amount required for the growth of the animals and the excess of proteins is only used for energy such that the nitrogen excretion in the form of urea increases. This results in a waste of expensive proteins and higher NH_3 emissions. Another consequence is the forced fat accumulation. This results in reduced proceeds from slaughtering with increased feed costs or a poor feed conversion ratio.

If the feed intake is overestimated, the supplied quantity of protein does not cover the necessary requirements for the growth of the animals. The growth potential of the animals is not fully utilised due to a lack of protein or amino acid; lower daily increases and a higher fat accumulation are the direct result and lower proceeds from slaughtering and a poor feed conversion ratio are further consequences. Similar consequences result from an

overestimated daily increase in weight or in an underestimated daily weight increase.

The assumptions often predefined in the prior art in regard to the feed quantity intake and the daily increases in for example gram per day or gram per day and animal are now used as the actually measured variables in the EDP system to determine a closed control loop for the composition of the feed in particular on the basis of protein and energy content. Furthermore, other desired additives, e.g. vitamins can in this way be mixed into the feed to adapt it. Adapting the protein in a fully automated and continuous manner to the required amount can reduce the feed costs and optimise the nitrogen excretion. The fat accumulation of the fattening pigs is also reduced leading to higher proceeds from slaughtering with simultaneously low feed costs, leading to an optimised result.

Regulation takes place automatically by means of the EDP system, which can for example be an industry PC in whose working memory a corresponding computer program runs. This program, which optimises the feed composition based on the measured values, is supplied with the information from the weighing unit and the feeding system via the interfaces of the industry PC. Alternatively, the EDP system can also be part of the feeding system and be connected to the weighing unit(s) via one or a plurality of associated interfaces. It can also be designed in multiple parts having a plurality of PCs which in particular communicate with one another and are set up in a distributed manner.

In a design not according to the invention, the farm animals are handled individually such that the desired

growth of the individual animal is optimally regulated. The feed composition resulting for the individual animal can then be appropriately mixed and made available for the farm animal. This presupposes that an individual feeding place is made available for each animal or the feed possibly still present from a previous animal is disposed of from the feeding place. Similarly, this presupposes that the animals are also already individualised upon being weighed. As weighing units, mechanically, mechanically-electrically or even optically operating weighing units can be used. The latter can also be used for identification. Alternatively or in addition, the farm animals can also be chipped for individualisation purposes and can for example be provided with an RFID chip or another near-field communication means.

In order to reduce the material outlay resulting from individualisation, it may be advantageous in the case of the design according to the invention when the farm animals, in particular of a stable passage, are divided into different groups on the basis of their feed conversion ratio. An average feed composition can be determined in the EDP system in each case on the basis of in particular the protein and energy requirement for these different groups. In particular, the groups of the division or clustering of the individual feed compositions of individual animals or individual groups of farm animals already selected beforehand result. For a cluster of animals, to which a similar feed composition is individually assigned, an average composition of the feed of farm animals is therefore for example determined in the EDP system. Optionally, an average weight increase of a cluster can

also be used in the calculation together with an average feed quantity intake.

The composition of the feed with protein contents and energy contents to be achieved, for example supplemented by taking into account further feed components such as vitamins or determined fibres and also taking into account for example the costs of individual components, represents an optimisation problem for which there are a number of solutions.

The fibre content in the feed is preferably adapted in particular to achieve the desired lean meat proportions of the farm animals.

Furthermore, it is advantageous according to the invention when the farm animals are weighed on the way to the feeding place and therefore prior to the feed intake. The weight determination is therefore unaffected by the feed intake.

In the case of a further configuration of the method according to the invention, the farm animals are weighed on the way back from the feeding place. It has namely been shown that pigs are rather clean animals and do not defecate at the feeding place. The feed quantity intake can therefore be individually assigned to a pig from the weight determination on the approach run to and return run from the feeding place. This requires that the pigs can be individualised not only in the approach run but also in the return run. Accordingly, approach run and return run must be provided with a device for identification.

In a further design of the invention, in the case of deviations of the resulting feed composition from the recommendations for example provided by the Deutsche Landwirtschafts-Gesellschaft (German Agricultural Society), the farmer will be notified about the deviation by the software running on the EDP system. An optimised feed composition may be suggested here so that, preferably following a confirmation by the farmer, the feed can be adapted to the currently prevailing fattening conditions or it can be dismissed. The optimisations are carried out separately for each animal or for each subgroup of animals.

The object defined at the outset is also achieved by a device for carrying out the method described above and/or below which comprises a feeding system with a feed quantity recording system and having a plurality of supply containers for the respective components of the feed. The device also comprises at least two feeding places, at least one weighing unit in the approach run to the respective feeding place, optionally at least one weighing unit in the return run from the feeding place and an EDP system which processes the data of the feeding system and the weighing unit(s) and which is provided with a computer program which determines an individual feed composition on the basis of the in particular daily recording of the weight and feed quantity consumption on an automated basis; divides the farm animals into different groups by clustering the individual feed compositions of individual farm animals or of individual groups of farm animals already selected beforehand and controls the feeding system in such a way that feeding of the farm animals takes place ad libitum and such that one of the feeding places (12, 13) is made available to the respective farm animal via the at least

one sorting gate (9) depending on group membership, with an averaged feed composition, as described above, being made available to the feeding place. The feeding places are accessible to the farm animal via at least one sorting gate only. The sorting gate is for this purpose equipped with means for identifying the animal and said animal can then be guided to the correct feeding place, controlled by the specifications of the EDP system. It is understood that the feeding system has further components with which the person skilled in the art is familiar, such as e.g. mixers and pipelines to the feeding places/feeding troughs of the farm animals.

The individual parts of the device according to the invention, such as weighing unit, sorting gate and, if the EDP system is not part thereof, a feeding system, are connected to the EDP system via communication interfaces such that data can be transmitted in a wired or wireless manner. The individual parts of the device can themselves in turn be provided with EDP units which for example individualise the animals.

Further advantages and details of the invention can be inferred from the following description of the figures, wherein it is schematically shown:

Fig. 1: a flow diagram of a part of the method according to the invention,

Fig. 2: a part of a device for carrying out the method according to the invention.

Individual technical features of the following description of the figures can be combined to form subject matters according to the invention in combination with the features of the independent claims and optionally any further claims. If appropriate, functionally identical elements are provided with identical reference numerals.

A method according to the invention for ad libitum feeding of farm animals is described in part in Figure 1. A main control loop for determining the feed composition from, for example, mixed and base feed is partially illustrated. The weight of the farm animal is determined on a daily basis by means of a weighing unit 1 located in the approach run to a feeding place. The daily increase in gram per day is calculated in step 2 by means of the EDP system. Using the predefined values, e.g. curves or tables, the protein requirement of the respective animals in gram per animal and day and the energy requirement of the respective animals in MJ per animal and day is determined in the EDP system following steps 3 and 4. In parallel or also at another time of day, the feed intake of a determined animal in gram per day is defined by means of a feed quantity recording system of a feeding system 5. Optionally, this feed quantity intake can also be averaged for an individual animal over a day period from the total intake of a group which at present is to be handled the same way. Based on this data, the protein and energy content of the feed can then be determined in the positions 6 and 7 for a group of animals with identical performance parameters in an animal-specific or even group-specific manner. The composition of the feed (position 8) is then determined therefrom. Following feeding with this feed, the weights and feed intakes are then in turn once again determined in the

control loop at a later time, in particular even the next day, but at least a few days later.

Certain contents or, for special components, even limits, which should not be exceeded or undercut, can be predefined for the feed composition in the program of the EDP system. Vitamins, minerals or even individual amino acids such as lysine can be covered via definable or predefined feed ingredients and be included in the calculation of the composition as a component. If all selected components are also defined or stored with costs, the composition can also be optimised in the computer program automatically on the basis of minimising the costs.

In order to be able to set the energy level of the respective ration to meet the requirements, a cost-effective raw fibre source with low energy content can be used for example as a feed component. Whole-plant corn or cereal silage are ideal components for configuring the composition in order to control the energy density when using a liquid feed. Higher proportions of raw fibre mixed feed can reduce the nitrogen emissions here by up to 40% because nitrogen does not have to be excreted via the urea, but rather is fixed in faeces. The pH value in the faeces and therefore in the manure is low and the NH_3 release from the manure reduces as a result of this alone. Adapting the protein in a fully automated and continuous manner to the required amount can reduce the feed costs and optimise the nitrogen excretion. The fat accumulation of the fattening pigs is also reduced, leading to higher proceeds from slaughtering with simultaneously low feed costs, leading to an optimised result.

A device for carrying out the method according to the invention is represented in Figure 2. A first weighing unit 10 is located in the approach run to a sorting gate 9. A separating region 11 and two different feeding places 12 and 13, which are spatially separated from one another, can be controlled via the sorting gate. The farm animals can be fed on the basis of the two subgroups in this case in these feeding places 12 and 13. After the animals have fed, they can be weighed via the weighing units 14 present on the return run. The animals can then also enter the activity region 15, the lounging region 16 and the outer region 22 via this route. Therefore, the farm animals can be weighed both before feeding and also after feeding such that a correspondingly individual feed intake can be determined for the animals simultaneously individualised when passing through. An EDP system 20 is located together with a part of the feeding system in a room 17 from which the individual troughs 18 and 19 of the feeding places 12 and 13 are supplied. The supply lines and the mixing unit supplied from supply containers 21 are not represented.

P A T E N T K R A V

1. Fremgangsmåde til at fodre nyttedyr med foder som blandes og/eller klargøres i et foderanlæg, i hvilket der sker en fodermasseregistrering, og derfra transporteres til mindst én foderplads (12, 13), hvor en sammensætning af foderet forudgives via et EDB-anlæg (20) med hensyn til relevante komponenter for fodring af nyttedyrene, især i forhold til protein-, energi- og/eller fiberindhold, og hvor vægten af nyttedyrene bestemmes ved hjælp af mindst én vejeenhed (10) og/eller EDB-anlægget (20), hvor vægtstigningen af nyttedyrene bestemmes i vejenheden (10) og/eller EDB-anlægget (20), hvorpå en fodersammensætning som er tilpasset til nyttedyrene, bestemmes, især dagsaktuelt, i EDB-anlægget (20) på automatiseret vis og nyttedyrene fodres på en tilpasset måde, hvor der sker en ad libitum fodring af nyttedyrene og den af nyttedyrene indtagne fodermasse bestemmes ved hjælp af foderanlægget og/eller EDB-anlægget,

k e n d e t e g n e t ved, at nyttedyrene inddeles i forskellige grupper ved at gruppere de individuelle fodersammensætninger af individuelle nyttedyr eller individuelle grupper af nyttedyr som er udvalgt på forhånd, og én af flere rumligt adskilte foderpladser (12, 13) som er forsynet med forskellige fodersammensætninger, gøres tilgængelig for det respektive nyttedyr afhængigt af gruppetilhørsforholdet via mindst én sorteringssluse (9), og hvor en gennemsnitlig fodersammensætning stilles til rådighed for en foderplads (12, 13).

2. Fremgangsmåde ifølge krav 1, k e n d e t e g n e t ved, at nyttedyrene inddeles i forskellige grupper med hensyn til deres foderudnyttelse.

3. Fremgangsmåde ifølge krav 1 eller 2, k e n d e t e g n e t ved, at en gennemsnitlig fodersammensætning bestemmes i EDB-anlægget for hver af de forskellige grupper af nyttedyr.

4. Fremgangsmåde ifølge et af de foregående krav, k e n d e t e g n e t ved, at fiberindholdet i foderet især er tilpasset til at opnå ønskede andele af magert kød af nyttedyrene.

5. Fremgangsmåde ifølge et af de foregående krav, k e n d e t e g n e t ved, at nyttedyrene vejes på vejen til foderpladsen (12, 13).

6. Fremgangsmåde ifølge et af de foregående krav, k e n d e t e g n e t ved, at nyttedyrene vejes på vejen tilbage fra foderpladsen (12, 13).

7. Fremgangsmåde ifølge et af de foregående krav, k e n d e t e g n e t ved, at fodersammensætningen bestemmes i EDB-anlægget (20) især afhængigt af mindst den aktuelle vægtstigning og det aktuelle fodermasseindtag af nyttedyret eller nyttedyrene.

8. Indretning til at gennemføre fremgangsmåden ifølge et af de foregående krav, omfattende et foderanlæg med en fodermasseregistrering og med flere forsyningslagre (21), en flerhed af foderpladser (12, 13) som kun er tilgængelige for nyttedyrene via mindst én sorteringssluse (21), mindst én vejeenhed (10) i tilgangen til foderpladsen, eventuelt mindst én vejeenhed (14) i tilbagegangen fra foderpladsen (12, 13) og et EDB-anlæg (20) som bearbejder dataene af foderanlægget og vejeenheden/-erne (10,14) og til dette formål er forsynet med et computerprogram, som på automatiseret vis bestemmer

en individuel fodersammensætning på basis af især den daglige registrering af vægt og fodermasseindtag, hvor nyttedyrene inddeles i forskellige grupper ved gruppering af de individuelle fodersammensætninger af individuelle nyttedyr eller individuelle grupper af nyttedyr som er udvalgt på forhånd, og foderanlægget styres på en sådan måde, at der sker en ad libitum fodring af nyttedyrene og at én af foderpladserne (12, 13) gøres tilgængelig for det respektive nyttedyr afhængigt af gruppetilhørsforholdet via den mindst ene sorteringssluse (9), hvor en gennemsnitlig fodersammensætning stilles til rådighed for en foderplads (12, 13).

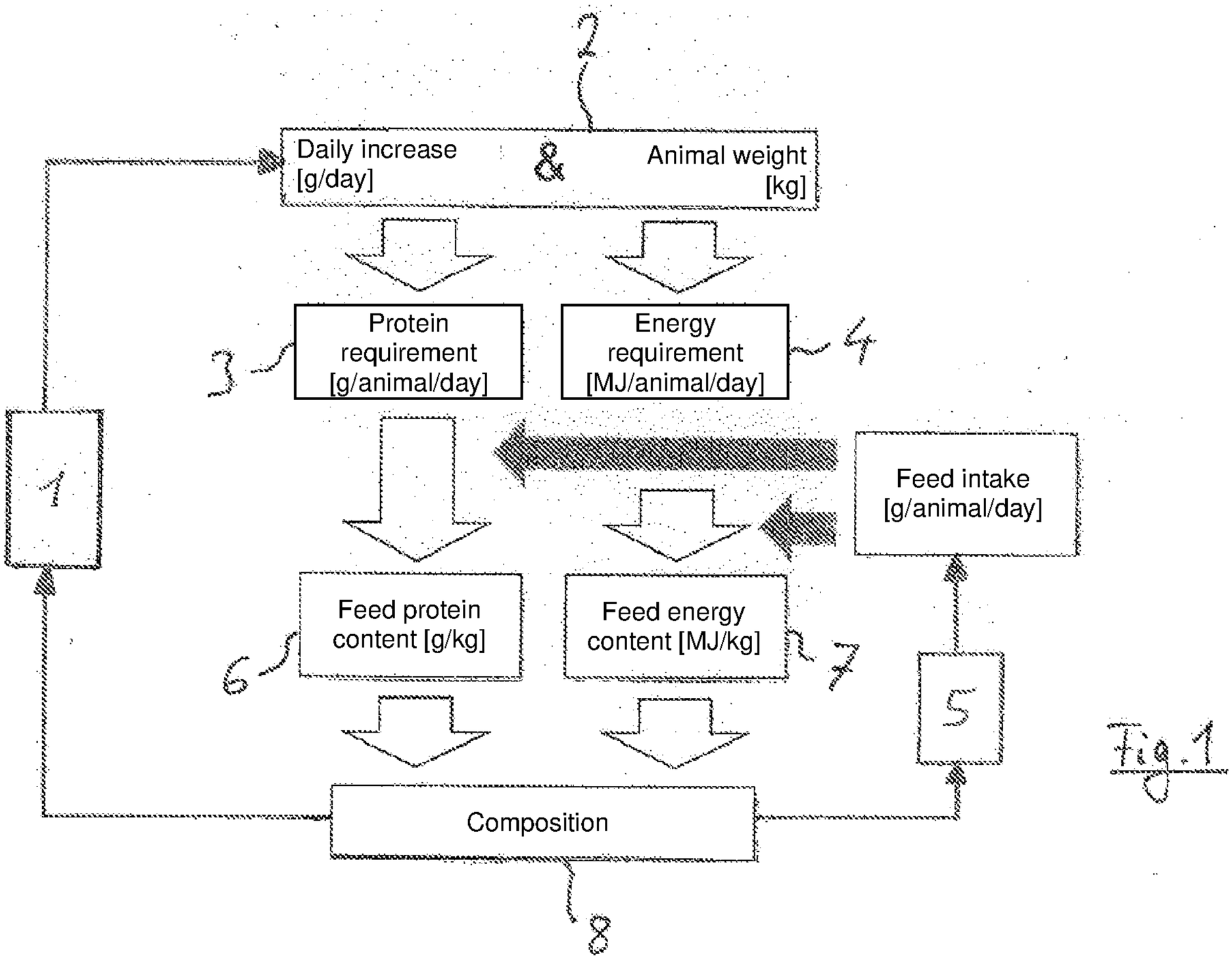
Daily increase [g/day]
&
Animal weight [kg]
Protein requirement [g/animal/day]
Energy requirement [MJ/animal/day]
Feed intake [g/animal/day]
Feed protein content [g/kg]
Feed energy content [MJ/kg]
Composition
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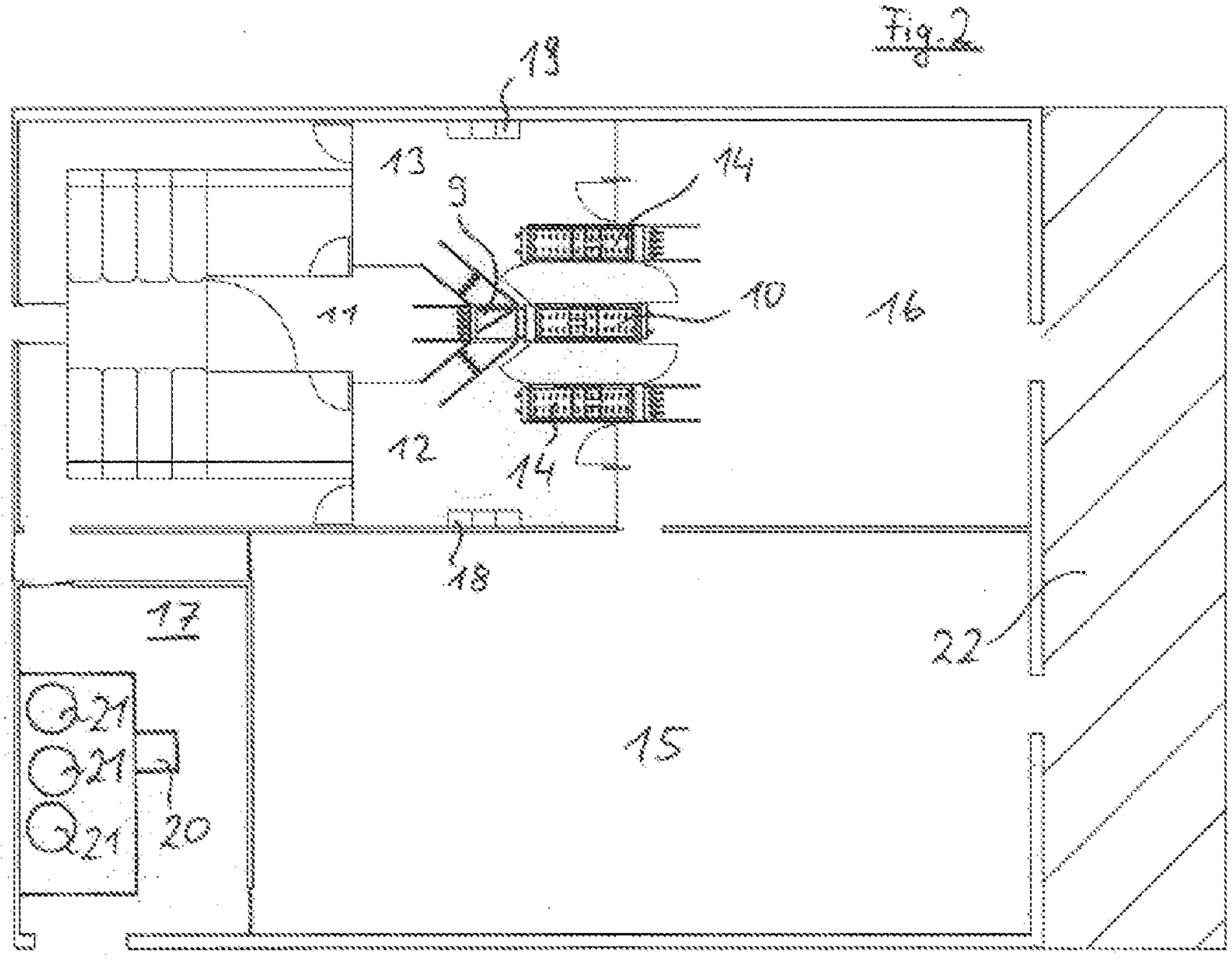
Fig. 1

Fig. 2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