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In-motion scales, especially conveyor scales comprising a conveyor belt

The invention relates to a conveyor scale, in particular to a weighing conveyor with a conveyor belt, with the features of the preamble of Claims 1 and 2.

Conveyor scales, for example weighing conveyors with a conveyor belt, are used in the food industry, among other things. Precisely in these cases, the cleaning of the conveyor scales plays an important part in order to be able to ensure the required hygiene or cleanliness of the products created. It must be pointed out in this case that the term "conveyor scale" is used throughout said description for all scales which comprise at least one load cell for detecting the weight of a product to be weighed, as well as an arbitrary means for supplying or removing the product to be weighed to or from the load cell or to the point or area of a weighing platform at which the weighing operation is carried out. A conveyor belt, which is coupled with the load receptor of the load cell such that the weight of a product to be weighed can also be determined during the movement thereof on the conveyor belt, is frequently used in the case of dynamic conveyor scales. A static conveyor scale can be configured, for example, such that in each case a product to be weighed is slid onto the weighing platform by means of a suitable feed device and after a successful (static) weighing operation is removed again from the weighing platform. The conveying means can therefore be configured in diverse ways, for example as a (relatively simple) robot arm, a slide or the like. They can be fastened as an option on the weighing platform or on the machine frame.

The cleaning of complex or sensitive production machines, such as, for example, high-quality conveyor scales, as a rule requires correspondingly trained personnel. Cleaning operations are often time-consuming as the conveyor scale has to be opened, for example at positions that are provided for this purpose, and cleaning of certain areas has to be carried out.

If conveyor scales, in particular weighing conveyors with at least one load cell and one conveyor belt, are used inside a production line for the production of foodstuffs in the food production industry, they are frequently developed in such a way that the weighing conveyor is covered to the greatest possible extent to increase measuring accuracy and

user safety. The conveyor belt can then be cleaned, for example, with a steam-jet cleaner. The cleaning operation is effected once the weighing conveyor has been disconnected and the conveyor belt is at a standstill.

If the cleaning of the conveyor scale, as sometimes applied, is undertaken during operation, there is on the one hand the risk of an operator being injured by moved elements of the conveying means or of the conveyor scale being damaged, for example if a steam-jet nozzle collides with a moved element of the conveyor means.

US 4,977,968 discloses a cleaning, washing and drying device for scales, in particular combination scales, which enables automatic cleaning, washing and drying of receiving containers for products to be weighed. The cleaning device, in this case, includes a pivotable arm, at the end of which a rotatable double wing is arranged in which several nozzles are provided for the liquid cleaning medium. The activation of the cleaning device can also be carried out by a correspondingly configured machine control of the scale.

US2005/0109580A1 describes a cleaning device for a transporting or conveyor belt which is arranged on the bottom run of the transporting belt which is guided about two rollers. Said device is suitable, in particular, for cleaning conveyor belts as are present at checkouts of shops. The function of the cleaning device is activated by means of a control unit such that after activation, which can be effected either automatically or by means of a detector signal, cleaning elements can be moved into contact with the bottom run of the conveyor belt. In addition, further components, such as a wetting device and a drying device are activated in a suitable manner.

Finally, US 6,135,268 discloses a cleaning method for the transporting belt of a belt conveyor, contaminants on the belt being detected during the operation thereof and then, where applicable, the drive being activated such that the contaminants on the belt are eliminated as a result of suitable stop and go reversing operations.

Consequently, the object underlying the invention is to create a conveyor scale, in particular a weighing conveyor with a conveyor belt, said conveyor scale enabling

simple and reliable cleaning even by untrained personnel.

Said object is achieved by the invention with the features of Claims 1 or 2.

The invention proceeds from the knowledge that it is advantageous in every respect when the conveyor scale, in addition to one or more weighing operating modes, comprises a cleaning mode in which the functions of the conveyor scale are controlled according to a predetermined cleaning mode function pattern such that a risk to operators and/or damage to the conveyor scale is reduced or avoided in the case of cleaning of the conveyor scale that is carried out manually.

The transferring of the conveyor scale into cleaning mode can be effected by the control device of the conveyor scale itself; for example, as a result of the control device switching automatically into cleaning mode at preset time intervals or at predetermined times or whenever the control device detects the end of a series of weighing operations. Obviously, however, the control device can also be transferred into cleaning mode on demand, for example as a result of pressing a switch which is connected to the control device or is comprised by the same or as a result of supplying an external signal.

The control device is preferably developed such that it is only possible to transfer into cleaning mode in admissible operating states or only from certain admissible operating states. In particular, transferring into cleaning mode can only be allowed if the conveyor scale is not to carry out any valid weighing.

According to a development of the invention, one or more cleaning mode function patterns can be stored in a storage area of a memory of the control device, wherein, in the case of several cleaning mode function patterns, the cleaning mode function pattern predetermined for the cleaning mode can be selected. The selecting of the suitable, predetermined cleaning mode function pattern in each case can be effected by the control device itself or also by supplying a corresponding signal from a higher-ranking control device.

According to the invention, means for detecting the torque of drive means of the conveying device are provided according to Claim 1, the torque signal of which is supplied to the control device. The predetermined cleaning mode function pattern is then selected such that the control device activates the drive means of the conveying device in cleaning mode in such a way that a predetermined safety barrier for the torque, that is to say a maximum admissible torque, is not exceeded. Said option according to the invention obviously also includes embodiments where parts of the control device are integrated into a corresponding drive. For example, the drive itself can include means for detecting the torque and control means which can switch the drive into various operating modes. In said case, the remaining part of the control device can supply a signal, which simply includes the value for the maximum admissible torque, to the part of the control device contained in the drive. Said value can also be transmitted, for example, as a digital value. The parts of the control device contained in the drive can then use said value in order to activate the drive at a corresponding maximum possible torque. In this way, it can be ensured that as a result of choosing a correspondingly low, maximum admissible value for the torque, a risk to operators is largely excluded, at any rate, however, is drastically reduced. In the same way, damage to parts of the conveyor scale, for example to the drive, can obviously also be avoided as a result. If, for example, the conveyor belt is blocked for a short time manually for the purpose of cleaning, the drive motor in cleaning mode with said cleaning mode function pattern does not attempt to force a movement as a result of a correspondingly high drive current, in the extreme case as a result of an inadmissibly high drive current.

According to Claim 2, the conveyor scale also has, according to the invention, an intervention protection device, for example one or more light barriers which produce an “intervention” signal and supply it to the control device if the intervention protection device detects the intervention of an operator in a hazardous area of the conveying device that is monitored by the intervention protection device and/or the opening of a protective cover for the conveying device. These types of intervention protection devices are known in the case of production machines and usually serve for the purpose of bringing the entire production machine or selected, moved parts to a standstill if the control device detects an “intervention” signal. In

the case of the conveying scale according to the invention, the detecting of an "intervention" signal does not, however, result in bringing the conveying device to a standstill or in disconnecting it. As a result, calibrating path or angle sensors can be omitted in the case of certain drive types and it can be made possible, for example, to carry out a movement of the conveying device when the cleaning mode is active.

The detecting of an "intervention" signal can also be used according to the invention for the purpose of changing the cleaning mode function pattern that is active at that time or selecting another of several stored cleaning mode function patterns.

According to various development of the invention, the one or more predetermined cleaning mode function patters can comprise one or more of the following additional functionalities:

(a) The drive means of the conveying device can be driven at a predetermined speed. The speed is preferably chosen in this case such that moved elements do not pose any risk to an operator or that the speed of movement facilitates the cleaning, for example as a result of sluicing contaminants away.

(b) The drive means of the conveying device can be driven in a predetermined direction of movement. Said functionality makes it possible to reverse or to change the direction of movement of a conveyor belt or of an arbitrary conveying device in cleaning mode in relation to the weighing operation mode.

(c) The drive means of the conveying device can be driven in respect of speed and/or direction of movement according to a predetermined time sequence. Said cleaning mode function pattern enables, for example, the running through a certain speed profile for a moved element of a conveying device, including a possible reversal of the direction of movement, such as, for

example, moving a conveyor belt forward and backward or moving a gripper or slider arm to and fro.

(d) The drive means of the conveying device can be activated in such a way that following the loss of a torque that brakes a moved element or stops the movement of moved element or following the loss of a corresponding force, the movement is resumed automatically according to the predetermined cleaning function pattern. As a result, this can prevent the entire cleaning operation being immediately stopped and having to be started again manually, for example when a moved element has been stopped manually.

(e) The drive means of the conveying device can be activated in such a way that one or more moved elements are moved into a cleaning position. The cleaning position, in this case, can be chosen in such a manner that ensures easy accessibility of the parts to be cleaned.

(f) In addition, means for sealing the load cell, in particular in the area of the load introduction, can also be activated. Said measure can prevent, in particular, the ingress of moisture and/or of cleaning agents in sensitive areas of the load cell.

(g) If the conveyor scale comprises an actuatable overload safety device for the load cell, this can be activated. For example, as a result of blocking the movement of the load receiver of the load cell, destruction of the load cell by inadmissibly high load forces (for example, if an operator – in an inadmissible manner – walks on the conveyor belt of a weighing conveyor) can be avoided.

(h) Finally, certain electric or electronic assemblies, in particular assemblies for the detection and/or evaluation of the weight force, can also be disconnected. As a result, the destruction of said assemblies as a result of moisture or cleaning agents is avoided. Assemblies which are necessary to carrying out the desired functions in active cleaning mode can obviously not be disconnected in this case; this applies at least for the time intervals in

which the relevant assemblies have to provide their functionality in cleaning mode.

According to the preferred embodiment of the conveying scale according to the invention, the control device does not supply any valid weight values in cleaning mode, for example for reasons of calibration. This can occur either such that the control device in general does not detect any weight values in cleaning mode or that weight values that are detected during a cleaning operation are emitted marked as invalid.

Further developments of the invention are produced from the sub-claims.

The invention is explained in more detail below by way of an exemplary embodiment shown in the drawing.

The single Figure shows a purely schematic representation of a development of a weighing conveyor according to the invention.

The weighing conveyor 1 includes a substantially closed housing 3 in which all essential components of the weighing conveyor 1 are provided, in particular a conveyor belt 5, which impinges upon the load receiver 7 of a load cell 9, and a control device 11.

The load cell 9 is connected to the control device 11 via one or more data lines 13 which can also be configured as a communication bus.

The conveyor belt 5 comprises, in a manner known per se, a transporting belt 19 which is guided about two rollers 15, 17. The roller 17 is driven by means of a drive that is not shown in any detail, for example an electric motor. A torque sensor 21, the sensor signal of which is supplied to the control device 11, is arranged on the driven roller 17 or on the drive for said roller. The torque sensor 21 can obviously also be integrated into the drive, for example into an electric motor. The control

device 11 controls the drive (not shown) for the driven roller 17 in the desired manner depending on the operating mode.

Obviously, part of the control device 11, to which the signal of the torque sensor 21 is supplied and which carries out the actual activation of the drive, can also be integrated in the drive. Just the desired operating mode for the drive can then be communicated to said part of the control device 11 by the remaining part of the control device. The connection between said two parts of the control device 11 can then be effected, for example, via a communication bus.

The weighing conveyor 1 shown in the Figure additionally comprises a housing flap 3a which can be opened, for example, for cleaning purposes, in particular can be folded outward. The closed position of the housing flap or protective cover 3a is detected by means of a limit switch 23. The signal of the limit switch 23 is also supplied to the control device 11. The control device 11 is able to detect an open housing flap 3a in this way.

A switch 25, the signal of which is supplied to the control device 11, or which is connected to the control device 11 such that said control device is able to detect the switch position, is provided on the outside surface of the housing 3. The switch 25 can obviously be configured in an arbitrary manner, for example as a push button.

In the normal weighing operation mode, products to be weighed are supplied on the input side to the weighing conveyor 1, moved through the housing 3 of the weighing conveyor 1 by means of the conveyor belt 5 and are removed again on the output side. The supplying or removing of the products to be weighed is symbolized by way of the arrows I (on the input side) and II (on the output side).

As long as the products to be weighed are situated on the transporting belt 19 of the conveyor belt 5, the weight thereof can be determined (after awaiting transient responses).

If the weighing conveyor 1, in particular the conveyor belt 5, is to be cleaned, the control device 11 can thus be transferred into a cleaning mode as a result of activating the switch 25. The activating of the switch 25 can be ensured by a safety device (not shown), for example by means of a combination lock, a card reader or the like.

An active cleaning mode can also be made recognizable to operators or to a higher-ranking control unit by the control device 11. To this end, a display unit 20 which is activatable by the control device can be activated. The display unit can obviously also be directly dependent on the position of the switch 25, and can indicate an active cleaning mode when the switch 25 is in the relevant switch position. A corresponding signal, which points to an active cleaning mode, can be transmitted to a higher-ranking control unit.

The control device 11 can obviously also perform the transfer into cleaning mode automatically, for example at predetermined times or after the expiry of certain time intervals.

In place of a switch 25, an external signal (not shown) can also be supplied to the control device 11. The control device 11 can be put into cleaning mode in this way, for example by a higher-ranking control unit.

In cleaning mode, the control device 11 can trigger a certain behaviour of the weighing conveyor 1, in particular of the conveyor belt 5, according to a predetermined cleaning mode function pattern. The cleaning mode function pattern predetermined for the cleaning mode can be stored in a storage area of a memory of the control device 11. Obviously, the cleaning mode function pattern can also be configured in a “hard-wired” manner in the control device 11.

Whilst the limit switch 23 or the signal supplied to the control device 11, which signals a “open” position of the housing flap 3a, results in an immediate stopping of the weighing conveyor 1, in particular of the conveyor belt 5, in the normal

weighing mode of the weighing conveyor 1, general disconnection of this type in cleaning mode can be unwanted.

For example, the cleaning mode function pattern can be chosen such that when the cleaning mode is active, the conveyor belt 5 continues running at a slower speed than is the case in weighing operation mode. As an addition to or as an alternative to a slower speed, the maximum torque which the drive of the driven roller 17 produces in cleaning mode, can be reduced in relation to the torque in weighing operation mode in order to avoid injuries to an operator or to reduce the risk of injury in a drastic manner.

The cleaning mode function pattern can be developed in a varied manner. Along with reducing the speed of movement or also reducing the maximum admissible drive torque, a reversal of the direction of movement can also be effected. A predetermined time sequence of a certain speed profile, including reversal of the directions of movement, is also possible.

As a result, it is possible, for example, to avoid the transporting belt 19 having to be disassembled for cleaning purposes. In particular, as a result of continuing to move the transporting belt 19 preferably in a slow manner, every area of the transporting belt 19 can be reached – for example by means of a steam jet. As a result of varying speeds and or directions of movement, particles of dirt can also be sluiced away from the transporting belt 19 or the rollers 15, 17.

Generally speaking, the drive means – the drive of the roller 17 in the exemplary embodiment shown – can be activated in such a manner in active cleaning mode that the movements carried out or the direction and the speed (where applicable according to a predetermined time profile) promote the cleaning effect and at the same time avoid or at any rate drastically reduce a risk of injuries to the operator or the risk of damage to parts of the conveyor scale or of the weighing conveyor 1.

The control device 11, according to the cleaning mode function pattern predetermined for the cleaning mode, can also disconnect electric or electronic

assemblies or circuits that are not required. This can refer in this connection, for example, to the electronics contained in the load cell 9 or included by said load cell. The achievement here at the same time is consequently that the weighing conveyor 1 does not output any weight values in active cleaning mode such that there is no risk of invalid weight values being produced and being incorrectly interpreted.

Should the producing and providing of weight values continue to be possible during cleaning mode, for example in the case of correspondingly provided cleaning mode function patterns, the cleaning mode function pattern can provide that the control device 11 identifies those weight values which are produced during an active cleaning mode as invalid weight values.

A further option for developing the cleaning mode function pattern is to activate an overload safety device for the load cell. A device, which supports the conveying belt 19 on the bottom surface in the activated state and thus blocks the introduction of a load force onto the load receiver 7 or delimits the load force, could be provided in the exemplary embodiment shown. As a result, during cleaning mode the load cell 9 is prevented from being damaged by (inadmissibly) high load forces.

A device (not shown in any detail) for sealing the load cell, in particular in the area of the load receiver 7, can be provided over and above this, it being possible to activate said device in cleaning mode. As a result, for example, the ingress of moisture and/or cleaning agents into the load cell can be avoided.

Finally, it must be pointed out that the invention is not restricted to the embodiment shown in the single Figure. The invention includes all conveyor scales which comprise at least one weighing cell and one conveying device of arbitrary type by way of which the products to be weighed are supplied to the load cell or are removed from said load cell. In this connection, this can consequently also refer to a static scale, the products to be weighed being supplied to the weighing platform of said static scale by means of a slide or a robot arm. In all these cases, the behaviour in active cleaning mode is able to be influenced as a result of providing

a suitable cleaning mode function pattern such that the cleaning operation is promoted and injury to operators or damage to the conveyor scale is avoided.

P A T E N T K R A V

1. Transportvægt, navnlig vejetransportør med et transportbånd,

(a) med en vejecelle (9) og en transportindretning (5) til gods, som skal vejes, navnlig stykgods, til tilførsel og bortledelse af godset til og fra vejecellen (9),

(b) med en styreindretning (11) til styring af funktionerne af transportvægten (1),

k e n d e t e g n e t ved

(c) at styreindretningen (11) kan overføres til en rengøringsmodus,

(d) at styreindretningen (11) i rengøringsmodussen styrer funktionerne af transportvægten (1) ifølge et forud givet rengøringsmodusfunktionsmønster,

(e) at rengøringsmodusfunktionsmønsteret er således udformet, at en fremkaldelse af fare for operatører og/eller en beskadigelse af transportvægten (1) ved en manuelt gennemført rengøring af transportvægten forringes eller forhindres, og

(f) at der er tilvejebragt middel (21) til registrering af drejemomentet af drivmidler af transportindretningen (5), hvis drejemomentsignal tilføres styreindretningen (11), og at det forud givne rengøringsmodusfunktionsmønster er udvalgt således, at styreindretningen (11) i rengøringsmodussen styrer drivmidlet af transportindretningen (5) således, at en forud givet sikkerhedsgrænse for drejemomentet ikke overskrides.

2. Transportvægt, navnlig vejetransportør med et transportbånd,

(a) med en vejecelle (9) og en transportindretning (5) til gods, som skal vejes, navnlig stykgods, til tilførsel og bortledelse af godset til og fra vejecellen (9),

(b) med en styreindretning (11) til styring af funktionerne af transportvægten (1),

k e n d e t e g n e t ved

(c) at styreindretningen (11) kan overføres til en rengøringsmodus,

(d) at styreindretningen (11) i rengøringsmodussen styrer funktionerne af transportvægten (1) ifølge et forud givet rengøringsmodusfunktionsmønster,

(e) at rengøringsmodusfunktionsmønsteret er således udformet, at en fremkaldelse af fare for operatører og/eller en beskadigelse af transportvægten (1) ved en manuelt gennemført rengøring af transportvægten forringes eller forhindres, og

(f) at der til transportindretningen (5) er tilvejebragt en indgrebsbeskyttelsesindretning (23), som frembringer og tilfører styreindretningen (11) et ”indgrebs”-signal, når indgrebsbeskyttelsesindretningen (23) detekterer indgriben af en operatør i et af indgrebsbeskyttelsesindretningen (23) overvåget fareområde af transportindretningen (5) og/eller åbning af en beskyttelsesafdækning (3a) til transportindretningen (5), hvor styreindretningen (11) i vejedriftsmodussen af transportvægten (1) standser transportindretningen (5) eller influerer i dens funktion, når den detekterer et ”indgrebs”-signal, og at styreindretningen (11) ved aktiv rengøringsmodus ikke standser transportindretningen (5), når et ”indgrebs”-signal detekteres.

3. Transportvægt ifølge krav 2, k e n d e t e g n e t ved, at styreindretningen (11) ved detektering af et ”indgrebs”-signal forandrer det forud givne rengøringsmodusfunkti-

onsmønster, eller udvælger et andet af flere lagrede rengøringsmodusfunktionsmønstre.

4. Transportvægt ifølge krav 1, k e n d e t e g n e t ved, at ét eller flere rengøringsmodusfunktionsmønstre er lagret i et lagringsområde af et lager af styreindretningen (11), hvor det til rengøringsmodussen forud givne rengøringsmodusfunktionsmønster i tilfælde af flere rengøringsmodusfunktionsmønstre kan udvælges.

5. Transportvægt ifølge ét af de foregående krav, k e n d e t e g n e t ved, at rengøringsmodussen kan aktiveres ved hjælp af en med styreindretningen (11) forbunden afbryder (25) eller ved hjælp af et til styreindretningen (11) tilført signal.

6. Transportvægt ifølge ét af de foregående krav, k e n d e t e g n e t ved, at styreindretningen (11) aktiverer rengøringsmodussen efter en forudbestemt tid eller et forudbestemt antal af vejeprocesser.

7. Transportvægt ifølge ét af de foregående krav, k e n d e t e g n e t ved, at den ene eller de flere forud givne rengøringsmodusfunktionsmønstre omfatter én eller flere af de følgende funktionaliteter:

(a) drivmidlet af transportindretningen (5) drives med en forud given hastighed,

(b) drivmidlet af transportindretningen (5) drives med en forud given bevægelsesretning,

(c) drivmidlet af transportindretningen (5) drives med hensyn til hastighed og/eller bevægelsesretning ifølge et forud givet tidsligt forløb,

(d) drivmidlet af transportindretningen styres således, at efter et bortfald af et bremsende moment eller et moment, som stopper bevægelsen, eller efter bortfald af en tilsvarende kraft, genoptages bevægelsen automatisk ifølge det forud givne funktionsmønster,

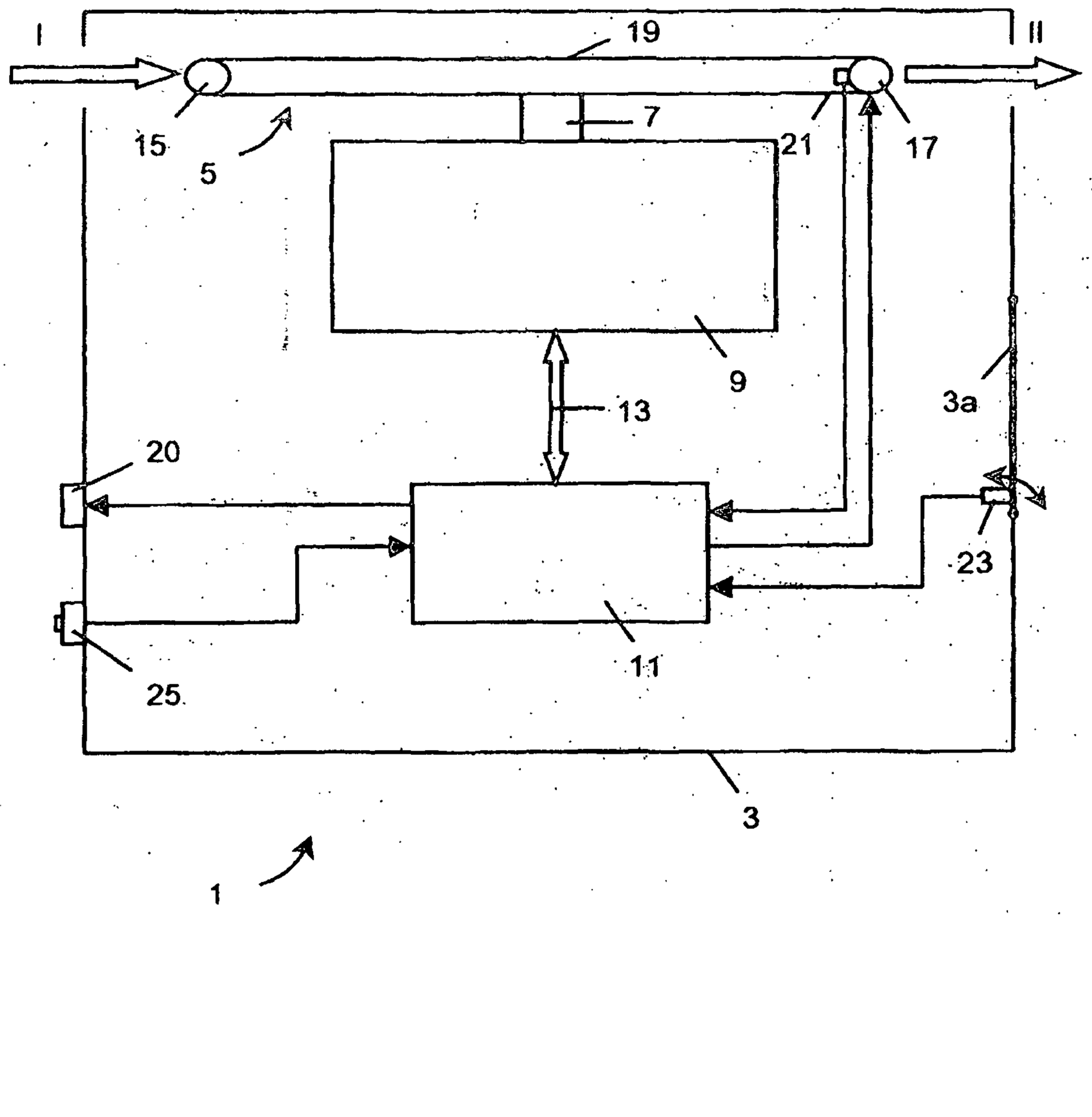
(e) drivmidlet af transportindretningen styres således, at ét eller flere bevægede elementer bevæges til en rengøringsposition,

(f) middel til tætning af vejecellen (9), navnlig i området af lastindførslen, aktiveres,

(g) aktivering af en overbelastningssikring til vejecellen (9).

8. Transportvægt ifølge ét af de foregående krav, k e n d e t e g n e t ved, at styreindretningen (11) i rengøringsmodussen ikke udlæser nogen gyldige vægtværdier.

9. Transportvægt ifølge ét af de foregående krav, k e n d e t e g n e t ved, at transportindretningen er et transportbånd (5).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