(19) DANMARK

(10) **DK/EP 4344529 T3**

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: ***A 01 D 34/835 (2006.01)*** ***A 01 D 43/08 (2006.01)*** ***A 01 D 45/02 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2025-05-19**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2025-02-19**

(86) Europæisk ansøgning nr.: **23196004.8**

(86) Europæisk indleveringsdag: **2023-09-07**

(87) Den europæiske ansøgnings publiceringsdag: **2024-04-03**

(30) Prioritet: **2022-09-30 DE 102022125382**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **Maschinenfabrik Bernard Krone GmbH & Co. KG, Heinrich-Krone-Straße 10, 48480 Spelle, Tyskland**

(72) Opfinder: **Ahlmer, Frank, , 49492 Westerkappeln, Tyskland**
Ester, Markus, , 49832 Beesten, Tyskland
Bolsmann, Martin, , 49832 Andervenne, Tyskland
FOCKS, TOBIAS, , 48480 Spelle, Tyskland
Lütke Lengerich, Steffen, , 48341 Altenberge, Tyskland

(74) Fuldmægtig i Danmark: **CHAS. HUDE A/S, Langebrogade 3B, 1411 København K, Danmark**

(54) Benævnelse: **Høstmaskine med et høstapparat og fremgangsmåde til drift af høstmaskinen**

(56) Fremdragne publikationer:
EP-A1- 3 272 199
EP-A1- 3 391 724
EP-A1- 3 881 665
DE-A1- 102021 114 960
DE-A1- 102021 120 012

HARVESTING MACHINE WITH A HARVESTING DEVICE AND METHOD FOR OPERATING THE HARVESTING MACHINE

The present invention concerns a harvesting machine with a harvesting device on which at least one mulching unit is arranged, wherein

- the harvesting device comprises a cutting and/or conveying apparatus for harvesting stalk-like crops, and
- the mulching unit comprises a processing tool that can be driven in rotation about a drive axis for processing plant stalks that remain in a field ground during harvesting, is arranged downstream of the cutting and/or conveying apparatus in a crop flow direction, is supported on the field ground in a working position during field operation, and is mounted on a frame of the harvesting device so as to be pivotable about a pivot axis relative to said harvesting device,

wherein the harvesting machine comprises a control unit and at least one sensor. The present invention further concerns a harvesting device and a mulching unit for the harvesting machine as well as a method for operating such a harvesting machine.

During the harvesting of stalk-like crops such as for example corn or sun flowers mulching devices are often employed in order to comminute plant stalks that remain in the ground. The comminution encourages the rotting process. Further, the comminuted plant stalks can be mixed in better during a subsequent processing of the ground. In addition, pest infestation, by way of example by the corn borer, can be prevented.

Such mulching devices are usually arranged on a harvesting device, in particular a harvesting header device, and downstream in a crop flow direction of a cutting device of the harvesting device provided for harvesting of the crops. They are arranged close to the ground and therefore repeatedly come into contact with obstacles such as by way of example stones or unevenness of the ground. Not only the processing tool of the mulching device are repeatedly loaded because of impact with such obstacles, but also their drive train, in particular transmission and/or couplings of the drive trains, so that damage can occur or at least wear occurs.

In order to prevent considerable damage in the drive train of the mulching device during an unfavourable impact of a processing tool of a mulching device with an obstacle such as a stone, the publication EP 3 881 665 A1 discloses an overload safety for a mulching device in which a connecting means is provided with which the processing tool is fastened to the mulching device. When an overloading occurs, it is foreseen that the connecting means breaks. By such a predetermined break, though the components of the drive trains of the mulching device are not

damaged, a repair of the mulching device is however necessary for continued travel on the field. In addition, tool asl well and its drive train are loaded up to the predetermined break of the connecting means, so that wear still occurs on the tool and on the drive train.

Such obstacles occur more frequently in the headland. In addition, a mulching device can penetrate into the field ground when driving backwards because of its arrangement close to the ground.

The publication EP 3 391 724 B1 discloses a self-propelled harvesting machine with a harvesting header device on which a mulching device is arranged. The harvesting machine comprises a speed sensor for detecting the propulsion speed. It is configured to transfer the mulching device in an out-of-service position when the propulsion speed falls below a minimum propulsion speed or when the harvesting machine drives backwards. As a result, the mulching device less frequently hacks itself into the field ground.

The publication DE 10 2021 114 960 A1 discloses a harvesting header for harvesting stalk-like plants with a mulching device, which comprises a shaft that can be driven in rotation by a drive, wherein a control device is configured to adjust the rotational speed of the drive based on signals supplied to it regarding the propulsion speed of the harvesting header and/or the inclination of the shaft relative to the vertical.

It is an objective of the present invention to provide a harvesting machine with a harvesting device on which a mulching unit is arranged, in which a wear at the mulching unit, the drive train of the mulching unit and/or the harvesting device is reduced and/or a service life of the mulching unit, the drive train and/or the harvesting device is increased, and which is be handled easily by the driver, wherein the mulching unit can be produced and/or operated at low cost.

This objective is achieved with a harvesting machine with the features of the independent claim 1 as well as a method with the features of the independent claim 16. Advantageous embodiments arise from the dependent claims.

To this end, a harvesting machine with a harvesting device is provided, wherein at least one mulching unit is arranged at the harvesting device, wherein

- the harvesting device comprises a cutting and/or conveying apparatus for harvesting stalk-like crops, and
- the mulching unit comprises a processing tool that can be driven in rotation about a drive axis for processing plant stalks that remain in a field ground during harvesting, is arranged

downstream of the cutting and/or conveying apparatus in a crop flow direction, is supported on the field ground in a working position during field operation, and is mounted on a frame of the harvesting device so as to be pivotable about a pivot axis relative to said harvesting device,

wherein the harvesting machine comprises a control unit and at least one sensor.

The harvesting machine is characterized in that the sensor is provided for detecting an overload acting on the processing tool, and the control unit is configured to pivot the mulching unit into a raised position relative to the working position when the overload is detected.

By the raising of the mulching unit when detecting the overload, the processing tool of the mulching unit can be raised above and away from an obstacle when in contact with said obstacle, such as by way of example a stone or an unevenness in the ground. Thereby it is automatically raised out of the blockade region. As the mulching unit is automatically raised out of the blockade region, the overload is lifted very quickly and the harvesting device is only briefly loaded. Moreover, the driver does not have to intervene, can focus his attention on the further harvesting operation and is not challenged or distracted by the observation of the mulching unit.

In so far as the processing tool has already penetrated into the field ground, it is raised out from said field ground very quickly. Wear therefore only occurs very briefly at the processing tool, whereby there is little wear, and the service life of the processing tools is high. Moreover, no maintenance effort is occasioned on the field by the overload, as the mulching unit can be operated further after occurrence of the overload.

In a preferred embodiment, the harvesting device is a harvesting header device für a, in particular self-propelled, harvesting machine. As such it is preferably arranged frontally on the harvesting machine. However, the mulching unit is also applicable for other harvesting devices, which by way of example can be pulled by a tractor or can be mounted at the rear.

In a preferred embodiment, the sensor is provided for detecting the overload, and is implemented as rotational speed sensor or as torque sensor, which is arranged on the mulching unit. The overload can then be detected directly on the mulching unit, in particular at or near the processing tool. Based on the multitude of implemented rotational speed sensors and torque sensors in technical devices, such sensors are obtainable very cost efficiently and the detection of the overload in the mulching unit can therefore be realized at low cost.

It is here preferred that the mulching unit comprises a transmission that is connected on the input side of a drive train of the harvesting device and/or the harvesting machine, and that comprises a tool-side output for driving the processing tool, wherein the sensor is arranged in the transmission. Because of the arrangement of the sensor in the transmission, the sensor is arranged near the processing tool. In a preferred embodiment, a sensor which is already provided for the detection of the drive rotational speed of the transmissions or the mulching unit is used as the sensor. No costs then arise for an additional sensor.

It is further preferred here that the sensor for the detection of the overload

- detects a rotational speed of the processing tool at the tool-side output of the transmission, or
- is implemented as a torque measuring hub and detects a torque on the drive side of the transmission or at the tool-side output of the transmission.

By the arrangement of the sensors at the tool-side output of the transmission, the processing tool is monitored close to the tool. The detection is therefore very accurate. Alternatively or additionally, it is preferred to detect the input rotational speed or the input torque of the transmission.

Preferably, the harvesting machine comprises a plurality of mulching units, wherein a transmission is respectively provided for each of the mulching units, wherein each of the mulching units comprises a sensor for the detection of the overload. This enables separate detection in each mulching unit of a respectively occurring overload.

In a preferred embodiment, the transmissions of two or more of the mulching units are connected to each other by means of Cardan shafts. Hereby, they are arranged behind each other in a row. To this end, the transmissions of the mulching units preferably each comprise a drive for driving a neighbouring transmissions of a neighbouring mulching unit. In a particularly preferred embodiment, the transmissions are each implemented as T- transmission. They therefor preferably each comprise a transmission shaft passing therethrough which at one end is drivable and at the other end is used for driving of the neighbouring transmissions. The transmission shaft is connected to the Cardan shaft at its ends preferably in each case by means of a Cardan joint in order to enable a spatial offset between the transmissions. A mulching unit can therefore be arranged spatially offset relative to its neighbouring mulching unit or units, in particular offset in height. The Cardan shafts therefore enable that each of the mulching units can be raised and/or lowered independently from a neighbouring mulching unit.

The harvesting device can comprise one or multiple drive trains for driving the mulching units. In a preferred embodiment, at least two mulching units that are connected to the same drive train and that

are connected to each other, respectively form a group. By such a grouping of the mulching units, the mulching units of the same group, in particular in relation to the torque and/or the rotational speed of their processing tools, can be monitored together. As the mulching units of the group are drivingly connected to each other, even in case of failure of the sensor of one of the mulching units, overload detection can still proceed by the drivingly connected further, in particular neighbouring, mulching units. Because of this, a sort of redundant overload detection is possible. With such a monitoring, a failure of malfunction of one of the mulching units of the group or one of the sensors of the mulching units can be detected.

When the overload occurs at one or at multiple mulching units, the mulching units, in particular in dependency from the available hydraulic power, separately or the mulching units of a group together can be raised from the working position into the raised position.

Alternatively, only one sensor can be provided for the monitoring of the overload of the mulching units of such a group, wherein the mulching units are pivoted together from the working position into the raised position when the overload occurs.

The harvesting device of the harvesting machine preferably comprises at least two portions, wherein each of the portions is assigned at least two mulching units, preferably more, in particular of the same group. Preferably, the mulching units of the portions are each arranged evenly distributed over a width of the portions. The portions of the harvesting device can be provided to be adjustable relative to each other, such that they are transferable by way of example by an adjustment mechanism reversibly from a working position into a transport position. In this embodiment, it is particularly preferred that at least one drive train for driving the mulching units is respectively provided for each of the portions of the harvesting device. The mulching units of each portion moreover particularly preferably form a group. The harvesting device comprises in addition preferably a main transmission which connects the drive trains in a power receiving manner with a power take-off of the harvesting machine.

It is here preferred that the control unit is configured to, when the overload occurs on a mulching unit, pivot this mulching unit separately, or together with the mulching units of the portion in which it is arranged, or together with the mulching units of the group to which it is assigned, from the working position into the raised position.

In a further preferred embodiment, the transmission comprises an overload clutch that is configured to drivingly disconnect the tool-side output of the transmission from the rest of the drive train. The

processing tool is thereby also drivingly disconnected from all other drive trains of the harvesting device and/or the harvesting machine when the overload occurs at the overload clutch. The overload clutch therefor not only serves to protect the overloaded mulching unit. All other drive trains and/or transmissions of the harvesting device and/or of the harvesting machine that are drivingly connected to said overload clutch are also protected by it. Damage therefor occurs less frequently at the processing tool of the mulching unit and/or at the harvesting device compared to conventional mulching units. Here, the overload causes wear at the overload clutch. However, the overload clutch can be arranged such that the wear is only very low by raising of the mulching unit.

When using a torque-maintaining overload clutch, the starting of the processing tool after overcoming the overload or blockade can proceed automatically. In this case, the driver is also not burdened with an overload occurring at one of the mulching units.

A reliable detection of the overload can proceed based on a plurality of calculations. Preferably, the overload is detected based on a threshold comparison. The control unit is preferably configured to detect the overload when

a) the currently detected rotational speed of the processing tool, or
b) a rotational speed difference between a highest of the currently detected rotational speeds of at least two mulching units, in particular of the same group, and a lowest of the currently detected rotational speeds of the at least two mulching units, falls below a threshold value, and/or when
c) the currently detected torque of the processing tool, or
d) a torque difference between a highest of the currently detected torques of at least two mulching units, in particular of the same group, and a lowest of the currently detected torques of the at least two mulching units, exceed a threshold value, and/or when
e) a difference of a drive rotational speed of the harvesting device or the harvesting machine and the currently detected rotational speed of the processing tool falls below a threshold value, or
f) a difference of a drive torque of the harvesting device or the harvesting machine and the torque of the processing tool exceeds a threshold value.

For the calculation, the threshold value can be provided as a nominal value of as a percentage value.

Alternatively or additionally, the control unit can also be configured to detect the overload when

g) an average rotational speed of the currently detected rotational speeds of at least two mulching units, in particular of the same group, or
h) an average rotational speed or a rotational speed difference of at least two temporally consecutive rotational speeds of the same mulching unit, or

i) an average rotational speed of respectively at least two temporally consecutive rotational speeds of at least two mulching units, in particular of the same group,

falls below the threshold value, or

j) an average torque of the currently detected torques of at least two mulching units, in particular of the same group, or

k) an average torque or a torque difference of at least two temporally consecutive torques of the same mulching unit, or

l) an average torque of respectively at least two temporally consecutive torques of at least two mulching units, in particular of the same group,

exceeds the threshold value. A plurality of other calculation methods is also possible.

The harvesting machine further preferably comprises a non-transitory memory in which the threshold value is stored. In a preferred embodiment, the threshold value is adjustably provided, in particular by the driver of the harvesting machine or a mechanic, in particular at an operator console. The control unit can in addition be configured for detecting the obstacles and for stoaring this data in the non-transitory memory. It is here preferred that at least the type of the obstacle, in particular stone or unevenness in the group, and its position is detected.

In addition, it is preferred that a sensor for detecting of a crop flow is provided in the harvesting machine, and the control unit is configured to pivot the mulching unit at reduced or absent crop flow relative to the working position into the raised position.

Because of the detection of a reducing or absent crop flow, it is achieved that the mulching unit is pivot into the working position during field operation only so long as crops are harvested. When no crops are harvested, the mulching unit is pivoted relative to the working position into the raised position, by way of example when the harvesting machine is stationary of during turning manoeuvres, in particular in the headland and/or when driving backwards. As the mulching unit is pivoted from the working position into the raised position when the crop flow is reducing or absent, an unnecessary operation of the mulching unit is avoided, so that no overload can at all occur at the processing tool. In the case, it can be further provided that the processing tool is not operated in the raised position of the mulching unit. This reduced the power required for the harvesting machine.

As an increased risk of a collision of the processing tool onto an obstacle, such as by way of example a stone or an unevenness in the ground, is expected in the headland and/or when driving backwards, the raising in dependency of the crop flow also lead to a reduced wear and an increased service life of the processing tool and/or its drive train. Because of the increased service life, the (maintenance)

costs for the mulching unit are additionally reduced at least on the long term or even at the medium term.

In this case, it is particularly preferred to use a crop flow sensor which is already present in the harvesting machine or the harvesting device. In order to detect the reduction and/or the absence of the crop flow as quickly as possible, it is preferred that the sensor is arranged in crop flow direction at an intake of the harvesting device or of the harvesting machine. Preferably, the sensor is arranged in the harvesting device. For example, it can be implemented as a NIR sensor (near-infrared sensor) or as an optoelectronic sensor. Likewise preferably, the sensor is arranged in an intake arrangement of the harvesting machine. In this embodiment, by way of example, it can be provided for measuring a deflection of an intake roll. Further preferably, the sensor is arranged in a discharge spout of the harvesting machine. By way of example, it is then implemented as a NIR sensor.

In a preferred embodiment, the control unit is configured to raise the mulching unit, when pivoting into the raised position, to a height above the field ground that is determined in dependency of an amount of the overload and/or an operation-relevant parameter, or in a preset height above the field ground. The preset height can, by way of example, be a height above the field ground determined based on experience, or a height above the field ground determined in dependency of the harvesting height of the harvesting device. In this case, the height above the field ground can be determined, by way of example, by a rotation angle of the mulching unit about its pivot axis. Preferably, it is detected by means of a rotation angle sensor at a pivot bearing of the mulching unit at which it is mounted on the harvesting device. The preset height is preferably stored in the non-transitory memory and further preferably adjustably provided by the driver of the harvesting machine or a mechanic, in particular at the operator console.

Alternatively, the height of the mulching unit in the raised position can be adjustable in dependency of an amount of the overload and/or an operation-relevant parameter. In this embodiment, the control unit is provided to calculate it when the overload occurs. Operation-relevant parameters are, by way of example, weather parameters, crops parameters, machine parameters and/or other parameters. By way of example, weather parameters comprise temperature, precipitation, ground humidity and/or air humidity, crops parameters comprise the crop type, crop flow and/or crop humidity, and machine parameters comprise an operational state, a rotational speed, a power usage or similar.

As the height of the mulching unit in the raised position is adjustable in dependency of the amount of the overload and/or the operation-relevant Parameter, the adjusted height of the mulching unit can for example lower for a lower amount of the overload than for a higher amount of the overload.

Therefore, the mulching unit can be pivoted back faster out of the raised position after overcoming an overload with lower amount compared to a lowering from a greater height at an overload with greater amount.

Further preferably, the control unit is configured to pivot the mulching unit back from the raised position into the working position in a time-controlled and/or path-controlled manner. Because of this, the mulching unit is maintained in the raised position for a predetermined time and/or a predetermined path when the overload is detected. After passing of the time and/or after driving of the path, the control unit pivots the mulching unit back into in the working position. For detecting the position of the overload and/or the travelled path, a position sensor, in particular of the satellite-supported type, can be used. By storing the position of the obstacle in the non-transitory memory and/or at a remote location, an evaluation of the obstacles of the worked field can be performed later in time. A later proceeding ground processing can pre-emptively take the obstacle into account or the field ground can be specifically reworked at a later point in time. For the detecting of the obstacles and for storing this data in a remote location, the harvesting machine preferably comprises a send and/or receive unit, with which these can be transmitted to the remote location, in particular a remote computer unit, in order to be requested and/or processed at a later point in time.

It is further preferred that the harvesting device comprises an actuator that is provided to pivot the mulching unit from the working position into the raised position and vice versa. The actuator can advantageously be implemented here as single-acting cylinder. In this embodiment, it can be obtained at low cost. The mulching unit can preferably be raised by the cylinder, wherein it is pressurized. By removing the pressure from the cylinder, the raised mulching unit can again be lowered in this embodiment. An advantage is that, if the pressure in the cylinder fails, a ground guidance of the mulching unit is possible as it is actuated at the pivot axis in a freely oscillating manner.

The objective is further achieved with a harvesting device for such a harvesting machine. The harvesting device comprises a cutting and/or conveying apparatus for harvesting of crops. It comprises at least one drive train for connecting at least one mulching unit, preferably multiple mulching units. The drive train is preferably connected to a main transmission of the harvesting device. Thereby, the at least one mulching unit is connectable in a power receiving manner to the main transmission of the harvesting device. Further, the harvesting device preferably comprises a frame to which the mulching unit is connectable, in particular a (transverse) carrier.

The at least one mulching unit is preferably releasably arranged at the harvesting device. It is then retrofittable and/or, for example for maintenance purposes, removable from the harvesting device.

The objective is further achieved with a mulching unit for such a harvesting device. The mulching unit comprises a processing tool for processing plant stalks that remain in the field ground during harvesting. Further, it comprises a sensor which is provided to detect an overload on the processing tool. Preferably, the sensor is arranged in a transmission of the mulching unit. It can for example be implemented as rotational speed sensor or as torque sensor.

The transmission is preferably connectable in a power receiving manner to a drive train of the harvesting device. Further, the mulching unit preferably comprises mounting means, in particular a console, with which is mountable to a frame, in particular to a (transverse) carrier of the frame, of the harvesting device. Alternatively, the mounting means, in particular the console, can also be arranged at the frame of the harvesting device.

The mulching unit further preferably comprises an actuator, with which the mulching unit can be raised from a working position into a raised position when an overload occurs and/or a reducing or absent crop flow occurs. In this case, it is preferred that the actuator extends between the mounting means, in particular the console, and a mulcher frame of the mulching unit.

The objective is further achieved with a method for operating such a harvesting machine, in which

- at least one rotational speed and/or at least one torque of a processing tool of a mulching unit of the harvesting machine is measured,

and an overload occurring on the processing tool is detected, in particular by a threshold value comparison, and in which the processing tool is pivoted from the working position into a raised position when the overload occurs.

An overloading of the processing tool can occur, when it penetrates into the field ground or hits an obstacle, for example a stone. In the method, the mulching unit impacted by the overload is raised out of the field ground or raised away from and above the obstacle which causes the overload. A burdening of the processing tool and its drive components only takes place for a very short time. The wear occurring in this case is therefore only slight. By raising the mulching unit, the method enables a very fast reduction or end of the overloading. The service life of the processing tool and/or of the mulching unit is therefore increased compared to conventional mulching units.

In a preferred embodiment, the method can further provide that a crop flow in the harvesting machine is measured, and a reduced or absent crop flow, in particular by a threshold value comparison, is detected, and in that the processing tool is pivoted from the working position into a raised position when the crop flow reduced or is absent.

Because of the detection of the reducing or absent crop flow, the mulching unit during field operation is only pivoted into the working position as long as crops are harvested. As the mulching unit is pivoted from the working position into the raised position with reducing or absent crop flow, an unnecessary operation of the mulching unit is avoided. As obstacles increasingly occur in the headland and/or the processing tool can penetrate the ground when driving backwards, the raising of the mulching unit in dependency of the crop flow also lead to a reduced wear and an increased service life of the processing tool and/or of the drive train.

The harvesting machine preferably comprises at least two mulching units, wherein the occurring of the overload further preferably is detected when either a rotational speed difference between a highest of the currently detected rotational speeds of the mulching units and a lowest of the currently detected rotational speeds of the mulching units fall below a threshold value, and/or a torque difference between a highest of the currently detected torques of the mulching units and a lowest of the currently detected torques of the mulching units exceed a threshold value. A plurality of further calculation methods are also possible for detecting the overload.

In particular, the rotational speeds and/or torques of all mulching units associated with each other can be taken into account for the detection of the overload. A pivoting back of the mulching unit or units can proceed time-controlled and/or path-controlled.

In a preferred embodiment, when the overload occurs on a mulching unit, this mulching unit or the mulching units of the portion in which it is arranged, and/or of the group to which it is assigned, are pivoted from the working position into the raised position.

The objective is further achieved with a method for operating such a harvesting machine with a harvesting device at which at least two or more mulching units are arranged, which are arranged in a portion of the harvesting device and/or assigned to a group of mulching units, wherein

- the sensors of the mulching units each measure a rotational speed or a torque,
- the occurrence of an overload, in particular with one of the previously described calculation methods under the subpoints a) - m), is determined, in particular when either a rotational speed difference between a highest of the currently detected rotational speeds of the mulching units

and a lowest of the currently detected rotational speeds of the mulching units falls below a threshold value, or a torque difference between a highest of the currently detected torques of the mulching units and a lowest of the currently detected torques of the mulching units exceeds a threshold value, and

wherein when the overload occurs on a mulching unit of the multiple mulching units, this one mulching unit or the mulching units of the portion and/or of the group to which it is assigned, is/are pivoted from the working position into the raised position.

In the following, the invention is described based on figures. The figures are merely exemplary and do not limit the general inventive concept. These show

Fig. 1 schematically a harvesting device for a harvesting machine according to the invention in a perspective view;

Fig. 2 schematically in (a) and (b) each a section of the harvesting device from Fig. 1 in various perspective views, and in (c) a mulching unit arranged at the harvesting device in a cross-section; and

Fig. 3 in (a) and (b) each a cross-section of various embodiments of a transmission for the mulching unit from Fig. 2 (c).

Fig. 1 shows a rear of a harvesting device 1 for the harvesting of crops in a perspective view. The harvesting device 1 is here implemented as harvesting header device and constructed in the way of a corn cutter. In the following, the terms harvesting device 1 and harvesting header device are used synonymously.

The harvesting header device 1 can be mounted in a way which is itself known at the front of a harvesting machine (not shown), for example a field shredder or a combine harvester, and is guided over a field ground (not shown) during field operation. The harvesting machine comprises a hoist, that is configured to adjust a height and/or an inclination of the harvesting header device 1 relative to the field ground. The harvesting header device 1 can further comprise one or multiple detection means, by way of example feelers, for detecting its height and/or inclination relative to the field ground. Based on the detected height and/or inclination, the hoist of the harvesting machine is controllable.

The harvesting header device 1 further comprises multiple portions 13, 14. A (in the plane of the drawing) left portion 13 and a (in the plane of the drawing) right portion 14 are arranged during field operation in a field position in which they are aligned approximately horizontal relative to the field ground. Fig.1 shows the harvesting header device 1 in the field position which is provided for the

field operation. In order to realise compact outer dimension during a road transport, the harvesting header device 1 is transferable from the field position in a transport position (not shown). For this purpose, the left portion 13 and the right portion 14 are adjustably implemented relative to each other and to a frame (not shown) of the harvesting header device 1.

During field operation, the harvesting header device 1 is guided in a driving direction 91 over the field ground, wherein a cutting and/or conveying apparatus 2 cuts stalk-like crops and transports it to an intake arrangement (not shown) of the harvesting machine.

It has proven advantageous to crush and/or fiberize plant stalks which remain in the field ground after the cutting, for example to stimulate a rotting of the plant stalks. For processing the plat stalks, the harvesting header device 1 comprises at least one mulching unit 4 which is provided for comminuting plant stalks remaining in the field ground. The mulching unit 4 is arranged behind the cutting and/or conveying apparatus 2 in a crop flow direction 11. The mulching unit 4 processes the plant stalks with a processing tool 41 (see Fig. 2 (b) and (c)) mechanically, after the cutting and/or conveying apparatus 2 has cut the crops, in particular near the ground.

To ensure that the plant stalks can be processed over a total working width of the harvesting header device 1, the harvesting header device 1 comprises a plurality of mulching units 4, that are arranged evenly distributed in a transverse direction 92, which extends transversely relative to the driving direction 91, over a width of the harvesting header devices 1.

In order to drive the mulching units 4, each of the portions 13, 14 is respectively provided with a drive train 3, within which the mulching units 4 arranged in the respective portion 13, 14 are driveable. The drive train 3 comprises in the harvesting header device 1 a driving shaft 31. It further comprises a transmission 7 for each of the mulching units 4. In addition, it comprises Cardan shafts 72, with which the transmission 7 neighbouring mulching units 4 are linkingly connected to each other. In Fig. 1, dust and/or spray protection means (not designated) are arranged in the right portion 14 around the Cardan shaft 72, which are not illustrated in the left portion 13 for clarification.

The harvesting header device 1 with the mulching units 4 is driven via a main transmission 8. The main transmission 8 comprises a power take-off connection 81, with which it is connectable in a power receiving manner to the harvesting machine. At the output side, it is connected to both of the driving shafts 31 of the drive trains 3 for driving the mulching units 4. Further, it is connected at the output side to a drive train (not shown) for driving the cutting and/or conveying apparatus 2. Even

further drive trains (not shown) for driving further components of the harvesting header device 1 could be provided.

In order to protect the mulching units 4, the transmissions 7, 8 and/or the drive trains 3 against overloading, the harvesting header device comprises sensor 6 (see also Fig. 3), which are provided for detecting an overload occurring on one of the mulching units 4. In the present exemplary embodiment, each transmission 7 that is foreseen for driving one of the mulching units 4 comprises a sensor 6.

The harvesting machine and/or the harvesting header device 1 can further comprise a sensor 6' that is implemented as crop flow sensor for detecting a crop flow in the harvesting header device 1 and/or in the harvesting machine. The sensor 6'is here arranged in the harvesting header device 1. It can be implemented as a NIR sensor or as an optoelectronic sensor. Alternatively or additionally, a sensor for detecting a deflection of an intake roll, which is arranged in an intake arrangement of the harvesting machine, can also be used as crop flow sensor. Further, each sensor, which is arranged in an ejection arch of the harvesting machine and for example is implemented as NIR sensor, can alternatively or additionally also be used for detecting the crop flow.

The sensors 6, 6' are connected with a control unit 5 that is configured to pivot the mulching units 4 from a working position S1 into a raised position S2 when detecting the overload and/or during reduced or absent crop flow. To this end, the mulching units 4 each comprise an actuator 44.

In the working position S1, the mulching units 4 lay, in particular with their weight force, on the field ground, while they are at a distance therefrom in the raised position S2. By raising, a mulching unit 4 is or multiple mulching units 4 are guided to a height over the field ground. Unevenness/protrusions in the ground and/or obstacles can thereby be overcome without overloading the harvesting header device 1, the mulching units 4 and/or the drive train 3.

In case of a reduced or absent crop flow, all mulching units 4 of the harvesting header device 1 are raised. Unnecessary operation of the mulching units 4 is thereby avoided, so that overload cannot even arise at the processing tool 41.

In Fig. 1, the mulching units 4 in the left portion 13 are all illustrated in the working position S1, while in the right portion 14 one of the mulching units 4 is shown in the raised position S2 relative to the others. The pivoting of the mulching unit 4 is further explained in the following based on Fig. 2.

Fig. 2 (a) shows a section of the right portion 14 of the harvesting header device 1 of Fig. 1 in a perspective view.

During field operation, the mulching unit 4 supports itself by means of a sliding runner 45 onto the field ground. The mulching unit 4 then lays onto the field ground with its weight force. It is than arranged in the working position S1.

The mulching unit 4 is pivotally mounted at the frame 12 of the harvesting header devices 1 so as to pivot about a pivot axis S. The pivoting of the mulching unit 4 about the pivot axis S enables the raising of the mulching unit 4 from the field ground. The pivot axis S extends in a transverse direction 92 transverse to the driving direction 91. Because of the raising, the mulching unit 4 in the raised position S2 is arranged at a distance from the field ground in a height direction 93, which extends transversely to the transverse direction 92 and transversely to the driving direction 91. The mulching unit 4 comprises the actuator 44 for the raising. The actuator 44 therefor extends between the harvesting header device 1 and the mulching unit 4. This is further described with Fig. 2 (c). The drive of the mulching unit 4, in particular of the processing tool 41, can be provided in a way that is can be switched off in the raised position S2, in particular automatically.

In order to process the plant stalks, the mulching unit 4 comprises the processing tool 41. The processing tool 41 is arranged seen in the height direction 93 under a covering 47 of the mulching unit 4 (see Fig. 2 (b) and (c)). The covering 47 prevents that processed plant stalks are thrown upwards with the processing tool 41 (see Fig. 2 (b) and (c)).

It can be seen that the Cardan shaft 72 of the drive train 3 extends between the mulching unit 4 which is arranged in the raised position S2 and the neighbouring mulching unit 4 which is arranged in the working position S1 in an angle (not designated) relative to the transverse direction 92. The transmissions 7 of these mulching units 4 are therefore arranged at an offset in the height direction 93 relative to each other. This is possible in that the Cardan shafts 72 between the transmissions 7 of the mulching units 4 are each connected by means of Cardan joints 78 to transmission shafts 76 of the transmission 7.

In the drive train 3, the transmissions 7 are arranged in rows (not designated) behind each other and are connected to each other by the Cardan shafts 72. To this end, the transmissions 7 are here implemented as T-transmission and each comprise the transmission shaft 76 (see Fig. 3) which passes through them. At the input side, the transmission shaft 76 of the first transmission 7 in the

row is connected to the driving shaft 31 of the harvesting header device 1 or to a gear transmission (not designated) that is arranged before said transmission 7. The transmission shafts 76 of the downstream transmissions 7 are each connected to the transmission shaft 76 of their neighbouring, upstream transmission 7. At the output side, the transmission shafts 76 of the transmissions 7, excluding the last transmission 7 of the row, are each provided for driving their neighbouring, downstream transmission 7. The Cardan shafts 72 are here also linked to the transmission shafts 76 of the downstream transmissions 7 by means of Cardan joints 78. This linking enables the spatial offset between the transmissions 7, so that each of the mulching units 4 can be raised relative to their neighbouring mulching units 4.

Fig. 2 (b) shows a section from the harvesting header device 1 of Fig. 2 (a) in a perspective view, in which a bottom side (not designated) of the harvesting header device 1 is visible with multiple mulching units 4. Visible are the processing tools 41 of the mulching units 4, which are each driveable in rotation about a drive axis 42 of their transmission 7. The drive axis 42 of the processing tools 41 are aligned transversely to the transmission shaft 76 of the transmission 7 (see also Fig. 3).

The processing tool 41 is fastened in a rotationally fixed manner to a tool-side output 71 (see Fig. 3) of the transmission 7, for example screwed thereto, so that the beater body 43 can be rotated about the drive axis 42.

It here comprises a blunt beater body 43 which is provided to process the plant stalks in the field ground. To prevent an imbalance, a plurality of beater bodies 43, in particular identical in construction, are arranged evenly distributed around the drive axis 42. Here, an embodiment with two beater bodies 43 is illustrated. However, three or more beater bodies 43 could be employed. In addition, blades could also be provided instead of the beater bodies 43.

The mulching unit 4 further comprises a mulcher frame 48 and the covering 47. The covering 47 is arranged above the processing tool 41. It prevents that processed plant stalks or agitated field ground are thrown upwards by the rotating processing tool 41. The covering 47 can hereby be implemented as a plate. The covering is fastened to the mulcher frame 48 which in particular is formed from braces and ribs. In addition, the transmission 7 is arranged above the mulching unit at a side of the covering 47 which faced away from the processing tool 41. The covering 47 extends in the crop flow direction 11 towards one end at which the sliding runner 45 is arranged.

The sliding runner 45 can be adjusted by means of a hole pattern and/or an elongated hole relative to the covering 47 and/or relative to the processing tool 41. Not illustrated here, although also within

the scope of the invention, the sliding runner 45 can also be implemented in an adjustable manner by means of an adjustment actuator (not shown), wherein the adjustment actuator is linked with one end to the mulcher frame 48 and/or the covering 47 of the mulching unit 4 and is linked with a further end to the sliding runner 45. By adjustment of the sliding runner 45, a height of the processing tool 41 relative to the field ground is adjustable in the working position S1.

Further, the cutting and/or conveying apparatus 2 is illustrated in Fig. 2(b). The cutting and/or conveying apparatus 2 here comprises a plurality of cutting elements 22 as well as a plurality of transport elements 23. The cutting elements 22 are implemented as rotatingly drivable cutting discs, and are arranged evenly over the working width of the harvesting header device 1. In order to cut the plant stalks, a knife beam or similar can also be used instead of these cutting elements 22.

In order to transport the crops, a circularly driven endless conveyor (not designated) is here used. Each portion 13, 14 of the harvesting header device 1 comprises at least one of such an endless conveyor. The conveyor elements 23 are arranged on the endless conveyor. Each of the conveyor elements 23 comprises a plurality of conveyor teeth 24 which are provided for taking along crops that have been cut by the cutting elements 23. Alternatively, a transverse conveyor in the form of a screw, rotating conveyor drums or similar can also be used as conveyor element 23.

Fig. 2(c) shows a side view of a cross-section of the mulching unit 4 that is arranged on the harvesting header device 1. In addition to the mulching unit 4, the linking of the mulching unit 4 to the frame 12 of the harvesting header device 1 can be seen.

The frame 12 of the harvesting header device 1 comprises a transverse carrier 15 which extends in the transverse direction 92 and which is screwed to a console 16. The console is therefore releasably fastened to the transverse carrier 15 and can be demounted by unscrewing. Other fastening means (not illustrated) can also be provided with which the console can be releasably fastened to the frame 12 of the harvesting header device 1, for example by rests or clamps, or in an non-releasable way, for example by gluing, welding or riveting,

The mulcher frame 48 is mounted on the console 16 so as to pivot about the pivot axis S. The pivot axis S can for example extend along a pivot shaft (not designated) formed by a bolt joint. Thereby, the mulching unit 4 in the working position S1 is suspended freely oscillating at the pivot axis S, is guided with its weight force over the field ground and can therefor follow a ground contour of the field grounds. The sliding runner 45 is provided for given support onto the field ground.

The actuator 44 for the pivoting of the mulching unit 4 extends between the harvesting header device 1, here the console 16, and the mulcher frame 48. It is fastened respectively to the console 16 and to the mulcher frame 48 by means of, for example, a bolt 441, 442, in particular rotatably about the respective bolt axis (not designated).

The actuator 44 is here implemented as a pneumatic and/or hydraulic cylinder and is in particular single-acting. By withdrawing a piston rod 443 of the actuators 44, the mulching unit 4 is raised relative to the field ground from the working position S1 into the raised position S2.

The transmission 7 is fastened at an upper side (not designated) of the covering 47, in particular at the mulcher frame 48 and/or the covering 47. It is therefore raised together with the mulching unit 4 when the mulching unit 4 is pivoted about the pivot axis S.

Visible is the transmission shaft 76 of the transmission 7. At the tool-side, the transmission 7 comprises an output 71 (see Fig. 3) which extends in the direction of the drive axis of the processing tool 41 and which can be rotatably driven by the transmission shaft 76. The processing tool 41 is fastened in a rotationally fixed manner to the drive 71 and is therefore driven about the drive axis 42 by the driving of the transmission 1.

The sensor 6 for detecting the overload is arranged in the transmission 7. This is described in relation to Fig. 3.

The overload on the processing tool 41 of the mulching unit 4 occurs with an impact of the processing tool 41 onto an obstacle, such as for example a stone or the field ground. The processing tool 41 is thereby braked and blocked. The torque acting on the processing tool thereby increases and the rotational speed is reduced. By implementing the sensors 6 as a rotational speed sensor 61 or as a torque sensor 62, such an impact onto the obstacle and the overload occurring with it are measurable.

Upon detection of the overload, the sensor 6 sends a signal to the control unit 5, which causes the actuator 44 to pivot the mulching unit 4 from the working position S1 into the raised position S2. In the raised position S2, the processing tool 41 is raised above the overload-causing obstacle and/or is raised out of the field ground.

The control unit 5 is hereby configured to raise the mulching unit 4 to a preset overload height. Alternatively, a height into which the mulching unit 4 is raised in the raised position S2 can also be set in dependency of an amount of the overload.

The control unit 5 is further configured to thereafter pivot the mulching unit 4 in a time-controlled and/or path-controlled manner back from the raised position S2 into the working position S1. The time-controlling and/or the path-controlling can also here with the pivoting of the mulching unit 4 back from the raised position S2 into the working position S1 proceed with presets or predetermined amounts for the time and/or the path, or in dependency of the amount of the overload.

Multiple mulching units 4 could also be assigned to a group. In this embodiment, it can be provided that the control unit 5, upon detection of the overload in one of the mulching units 4 of the group, pivots all mulching unit 4 of the group from the working position S1 into the raised position S2. In particular, the mulching units 4 of respectively one of the portions 13, 14 of the harvesting header device 1 and/or those mulching units 4 which are connected to the same drive train 3, can be assigned to one group and be pivoted together from the working position S1 into the raised position S2.

Fig. 3 shows in (a) and (b) various embodiments of a transmission 7 for such a mulching unit 4.

The transmissions 7 are each implemented as T-transmission. They each comprise a housing 77 through which the transmission shaft 76 passes. The transmission shafts comprise mutually opposing open ends 761, 762. The open ends 761, 762 are each, in particular by means of the Cardan joint 78 and Cardan shafts 72, connectable at an input side to the driving shaft 31 of the harvesting header device 1 or to the transmission 7 arranged upstream therefrom of the mulching unit 4 arranged upstream therefrom, and at an output side to the respective transmission 7 arranged downstream therefrom of the mulching unit 4 arranged downstream therefrom.

Each of the transmissions 7 comprises a bevel gear pair 74, 75 with a first bevel gear 74 which fully surrounds the transmission shaft 7 and a second bevel gear 75 which form a tool-side output 71. Both of the bevel gears 74, 75 each comprise teeth (not designated) which are engaging each other so that the second bevel gear 75 is driven when the first bevel gear 74 is driven. The processing tool 41 is, in particular at a fastening point 49, mounted to the tool-side output 71. The processing tool 41 is therefore also driven when the first bevel gear 74 is driven. The drive axis 42 (see Fig. 2 (c)) of the processing tool 41 is here aligned transversely to the transmission shaft 76 .

The transmission 7 comprises an overload clutch 73, which is here implemented as a ratchet coupling by way of example. The overload clutch 73 is provided to drivingly separate the drive train 3 from the tool-side output 71 of the mulching unit 4 when the overload occurs on the mulching unit 4. It therefore comprises engagement means (not shown) which in an engaged state (not designated) of

the overload clutch 73 are in spring-loaded engagement with counter engagement means (not shown) of the transmission shaft 76, in particular with recesses in the transmission shaft 76, and which get out of engagement with the counter engagement means when an engagement force is exceeded, so that the overload clutch 73 is decoupled from the transmission shaft 76. The overload clutch 73 then slips on the transmission shaft 76.

The first bevel gear 74 is mounted in a rotationally fixed manner to the overload clutch 73. In the engaged state of the overload clutch 73, it thus rotates with the transmission shaft 76. When the overload occurs on the processing tool 41, it is braked and blocked in such a way that the second bevel gear 75 is braked. The first bevel gear 74 is also braked because of this. In dependency of the force acting on the first bevel gear 74, that is when the engagement force is exceeded, the overload clutch 73 slips on, so that the processing tool 41 is drivingly separated from the transmission shaft 76 and thereby from the drive train 3. The drive train 3 is thereby protected against damage during overloading of the processing tool 41.

With the transmission 7 of Fig. 3 (a), the sensor 6 is implemented as rotational speed sensor 61. The rotational speed sensor 61 is fastened in the housing 77 and detects a rotational speed of the first bevel gear 74. As both bevel gears 74, 75 are in mutual engagement, the rotational speed of the tool-side output 71 is thereby also detected. The occurrence of the overload is detected when the rotational speed of the tool-side output 71 falls below a threshold value.

In so far as multiple mulching units 4 are assigned to a group, the occurrence of the overload can alternative be detected when a rotational speed difference between a highest of the currently detected rotational speeds of the mulching units 4 of the group and a lowest of the currently detected rotational speeds of the mulching units 4 of the group falls below a threshold value.

The rotational speed sensor 61 or the rotational speed sensors 61 send their measurement values to the control unit 5, which performs the threshold value comparison and upon detected overload pivot the mulching unit 4 or the mulching units 4 of the group from the working position S1 into the raised position S2.

Fig. 3 (b) shows an embodiment of the transmission 7 in which the sensor 6 for detecting the overload is implemented as torque sensor 62. The torque sensor 62 is here implemented in the form of a torque measuring hub 62. Therefor the terms torque sensor 62 and torque measuring hub 62 are used synonymously in the following.

Both of the bevel gears 74, 75 also in this embodiment each comprise teeth (not designated) which are in mutual engagement, so that the second bevel gear 75 is driven when the first bevel gear 74 is driven. However, no overload clutch 73 is visible here. Even then, the transmission 7 here also preferably comprises the overload clutch 73 to separate the tool-side output 71 from the drive train 3. The overload clutch can for example be integrated into the torque measuring hub 62.

The torque sensor 62 detect the torque present on the first bevel gear 74. As the first and second bevel gear 74, 75 are in mutual engagement, the torque present at the processing tool 41 is therefore detected. The occurrence of the overload is detected via a threshold value comparison, and in particular, when the torque exceeds a threshold value.

Also in this embodiment of the sensors 6 the overload can alternatively be detected for grouped mulching units 4, when a torque difference between a highest of the currently detected torques of the mulching units 4 of the group and a lowest of the currently detected torques of the mulching units 4 of the group exceed a threshold value.

The torque sensor 61 or the torque sensors 61 send their measurement values to the control unit 5, which performs the threshold value comparison and upon detection of the overload pivots the mulching unit 4 or the mulching units 4 of the group from the working position S1 into the raised position S2.

In both of the embodiments described with Fig. 3, the pivoting of the mulching unit 4 or mulching units 4 back from the raised position S2 into the working position S1 takes place automatically, in particular time-controlled and/or path-controlled. An automatic lowering of the mulching unit 4 or mulching units 4 in dependency of the rotational speed or the torque on the processing tool 41 or on the processing tool 41 is also conceivable.

The currently detected measurement values, in particular rotational speed or torque, of the sensors 6 and/or the occurrence of the overload can be shown on an operator console to the operator, for example in a driver cabin of the harvesting machine 1. Upon occurrence of the overload, an acoustic signal for the driver can alternatively or additionally be emitted.

When the overload occurs, navigation data, in particular from a GPS receiver (not shown) of the harvesting machine 1, can selectively be stored in order to selectively rework the field ground later.

PATENTKRAV

1. Høstmaskine (1) med et høstapparat (1), på hvilket der i det mindste er arrangeret en mulching-enhed (4), hvorved

* høstapparatet (1) omfatter en skære- (2) og/eller transportindretning (3) til høst af stængellignende afgrøde, og

* mulching-enheden (4) omfatter et bearbejdningsværktøj (41), som kan drives i rotation omkring en drivakse (42) med henblik på bearbejdning af plantestængler, der bliver tilbage i markjorden under høsten, hvilken mulching-enhed er arrangeret nedstrøms for skære- (2) og/eller transportindretningen (3) i en afgrødestrømretning (11), hvilken mulching-enhed er understøttet på markjorden i en arbejdsstilling (S1), hvilken mulching-enhed er monteret svingbart på en ramme (12) i høstapparatet (1) for således at kunne bevæges svingbart omkring en svingakse (S) i forhold til høstapparatet,

hvorved høstmaskinen omfatter en styringsenhed (5) og mindst én sensor (6),

kendetegnet ved, at

sensoren (6) er tilvejebragt med henblik på detektering af en overbelastning, som virker på bearbejdningsværktøjet (41), og styringsenheden (5) er indrettet til at bevæge mulching-enheden (4) svingbart til en løftet stilling (S2) i forhold til arbejdspositionen (S1) ved detektering af overbelastningen.

2. Høstmaskine ifølge krav 1,
kendetegnet ved, at sensoren (6) er tilvejebragt med henblik på detektering af overbelastning og er en hastighedssensor (61) eller drejningsmomentsensor (62), som er arrangeret på mulching-enheden (4).

3. Høstmaskine ifølge et af de foregående krav,

kendetegnet ved, at mulching-enheden (4) omfatter et drev (7), som på indgangssiden er tilsluttet til en drivstreng (13) i høstapparatet (1) og/eller i høstmaskinen og omfatter et værktøjsside-drev (71) til drivning af bearbejdningsværktøjet (41), hvorved sensoren (6) er arrangeret til detektering af overbelastning i drevet (7), og

* der på drevets værktøjsside-udgang (71) detekteres et omdrejningstal for bearbejdningsværktøjet (41), eller
* er udformet som drejningsmomentmålenav og på drivningssiden af drevet (7) eller på værktøjsside-udgangen (71) for drevet detekterer et drejningsmoment.

4. Høstmaskine ifølge et af de foregående krav,
kendetegnet ved, at den omfatter en flerhed af mulching-enheder (4), hvorved der for hver af mulching-enhederne (4) er tilvejebragt et drev (7), hvorved mulching-enheden (4) omfatter en sensor (6) til detektering af overbelastningen.

5. Høstmaskine ifølge et af de foregående krav,
kendetegnet ved, at drevene (7) i mulching-enhederne (4) ved hjælp af kardanaksler (72) er forbundet med hinanden.

6. Høstmaskine ifølge et af de foregående krav,
kendetegnet ved, at respektive mindst to mulching-enheder (4), der er tilsluttet til samme drivstreng (8), danner en gruppe.

7. Høstmaskine ifølge et af de foregående krav,
kendetegnet ved, at høstapparatet mindst omfatter to afsnit (13, 14), hvorved hvert af afsnittene (13, 14) har tilordnet mindst to mulching-enheder (4), navnlig i samme gruppe, og som er arrangeret jævnt fordelt over en bredde af afsnittene (13, 14).

8. Høstmaskine ifølge et af de foregående krav,

kendetegnet ved, at styringsenheden (5) er indrettet til, ved detektering af overbelastningen på en mulching-enhed (4), at svinge denne mulching-enhed (4) eller mulching-enhederne (4) i afsnittet (13, 14) af denne mulching-enhed (4) eller mulching-enhederne (4) i gruppen af denne mulching-enhed (4) fra arbejdsstillingen (S1) til den løftede stilling (S2).

9. Høstmaskine ifølge et af de foregående krav,
kendetegnet ved, at drevet (7) omfatter en overbelastningskobling (73), der er indrettet til driftsmæssigt at adskille drivstrengen (8) i høstapparatet og/eller høstmaskinen fra værktøjsside-udgangen (71) på drevet.

10. Høstmaskine ifølge et af de foregående krav,
kendetegnet ved, at styringsenheden (5) er indrettet til at detektere overbelastningen, når

a) det aktuelt detekterede omdrejningstal for bearbejdningsværktøjet (41), eller

b) en omdrejningstal-differens mellem et højeste af de aktuelt detekterede omdrejningstal for mindst to mulching-enheder (4), navnlig i samme gruppe, og et laveste af de aktuelt detekterede omdrejningstal for de mindst to mulching-enheder (4) underskrider en tærskelværdi, og/eller når

c) det aktuelt detekterede drejningsmoment for bearbejdningsværktøjet (41), eller

d) en drejningsmomentdifferens mellem et højeste af de aktuelt detekterede drejningsmomenter for mindst to mulching-enheder (4), navnlig i samme gruppe, og en laveste af de aktuelt detekterede drejningsmomenter for de mindst to mulching-enheder (4), overskrider en tærskelværdi, og/eller når

e) en differens mellem et drivomdrejningstal for høstapparatet (1) eller høstmaskinen og det aktuelt detekterede omdrejningstal for bearbejdningsværktøjet (41) underskrider en tærskelværdi, eller

f) en differens mellem et drivdrejningsmoment for høstapparatet (1) eller høstmaskinen og drejningsmomentet for bearbejdningsværktøjet (41) overskrider en tærskelværdi.

11. Høstmaskine ifølge krav 1,
kendetegnet ved, at der er tilvejebragt en sensor (6') til detektering af afgrødestrømmen, og styringsenheden (5) er indrettet til at svinge mulching-enheden (4) til den løftede position (S2) i forhold til arbejdspositionen (S1), når en formindsket eller fraværende afgrødestrøm er detekteret.

12. Høstmaskine ifølge krav 11,
kendetegnet ved, at sensoren (6') med henblik på detektering af afgrødestrømmen i høstapparatet (1) er arrangeret i et indtagsarrangement i høstmaskinen eller i et udkastningsudløb i høstmaskinen.

13. Høstmaskine ifølge et af de foregående krav,
kendetegnet ved, at styringsenheden (5) er indrettet til at løfte mulching-enheden (4) ved svingbevægelse til den løftede stilling (S2) til en højde, som er bestemt af størrelsen af overbelastningen og/eller en drifts-relevant parameter eller til en forud indstillet højde af overbelastningen.

14. Høstmaskine ifølge et af de foregående krav,
kendetegnet ved, at styringsenheden (5) er indrettet til tids-styret eller banestyret at svinge mulching-enheden (4) tilbage fra den løftede stilling (S2) til arbejdsstillingen (S1).

15. Høstmaskine ifølge et af de foregående krav,
kendetegnet ved, at høstapparatet (1) omfatter en aktuator (45), der er bestemt til at svinge mulching-enheden (4) fra arbejdsstillingen (S1) til den løftede stilling (S2) og omvendt.

16. Fremgangsmåde til drift af en høstmaskine ifølge et af de foregående krav, hvorved i det mindste et omdrejningstal og/eller i det mindste et drejningsmoment for et bearbejdningsværktøj (41) i en mulching-enhed (4) i høstmaskinen (1) måles, og hvorved en overbelastning, som optræder på bearbejdningsværktøjet (41), detekteres ved hjælp af en tærskelværdisammenligning, og bearbejdningsværktøjet (41) svinges fra arbejdsstillingen (S1) til en løftet stilling (S2), når der optræder overbelastning.

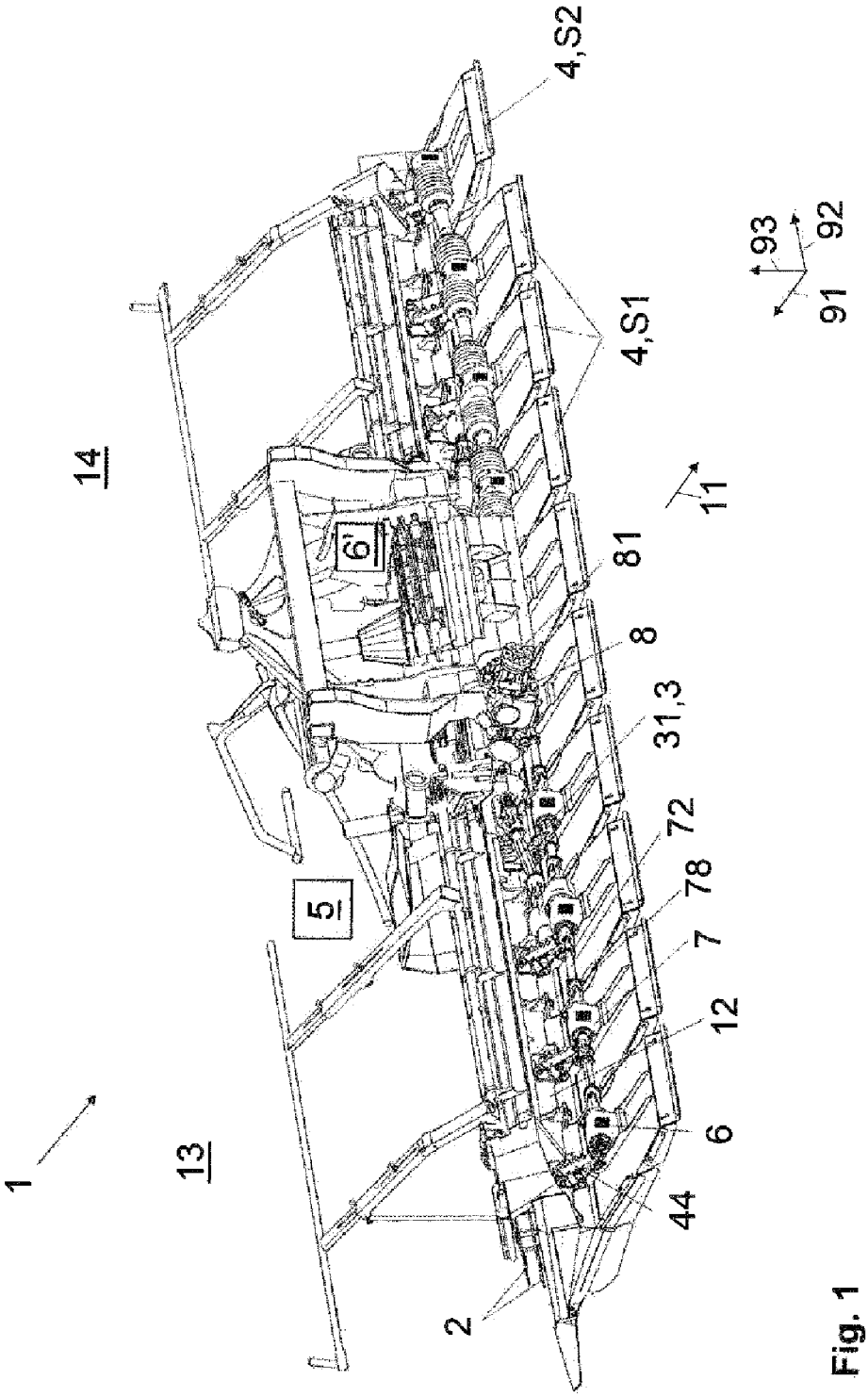


Fig. 1

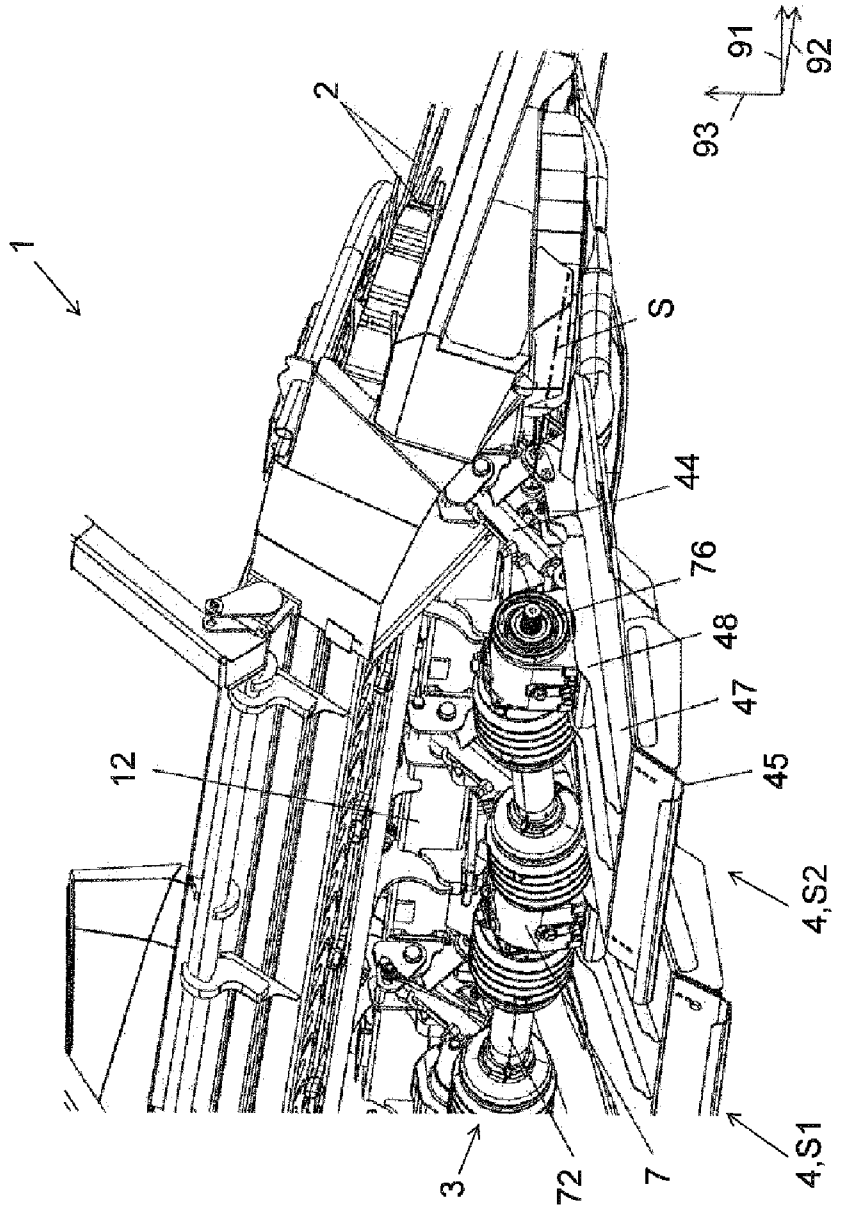


Fig. 2 (a)

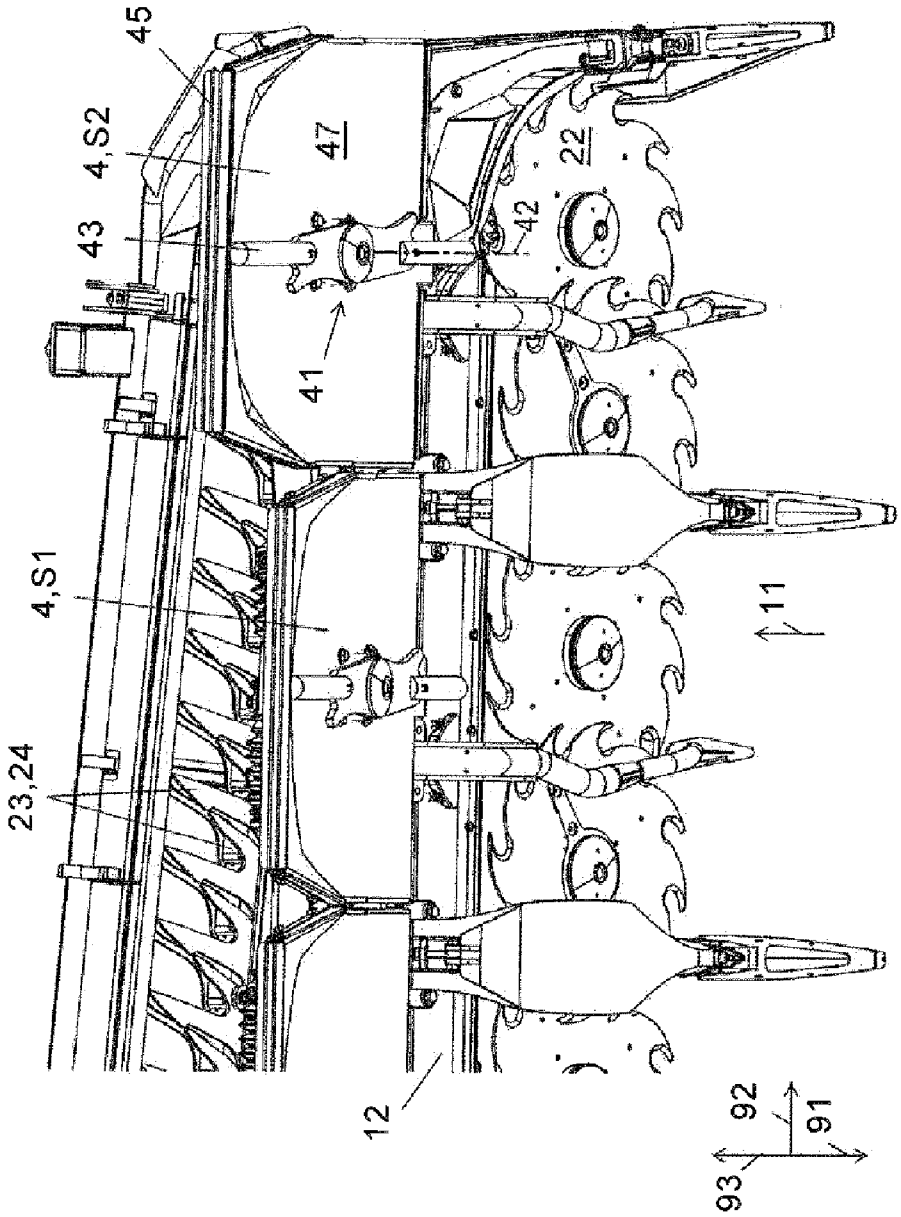


Fig. 2 (b)

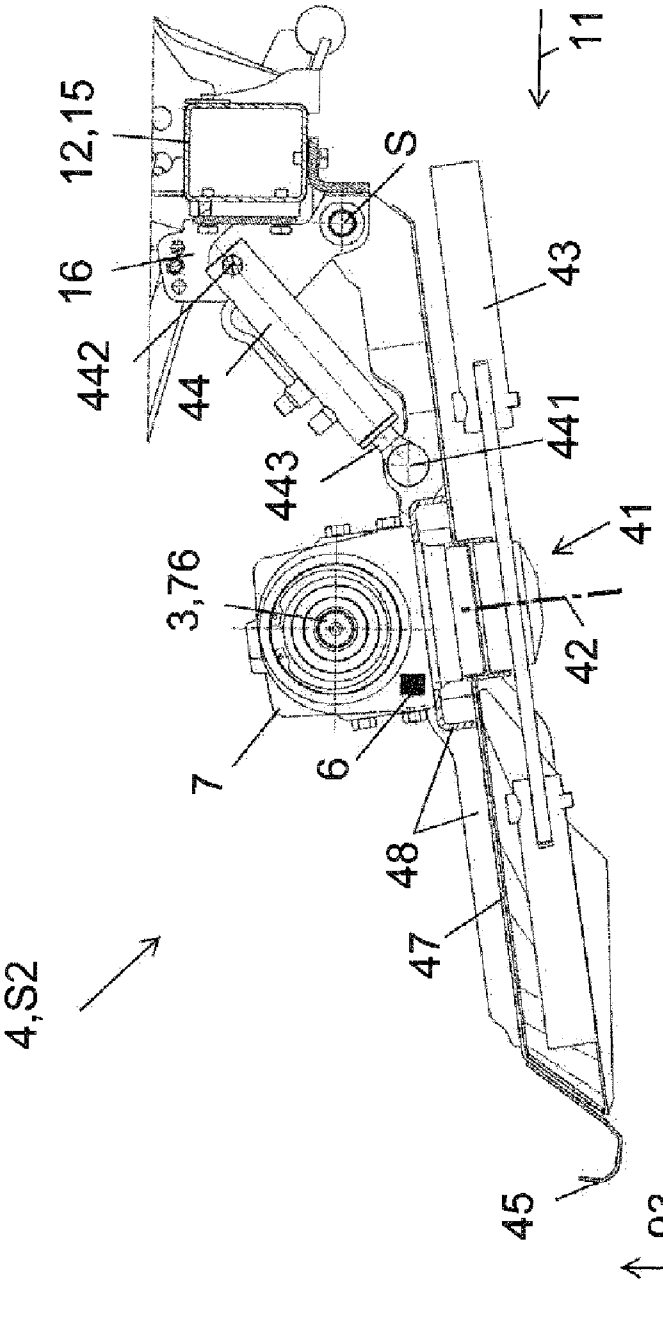


Fig.2(c)

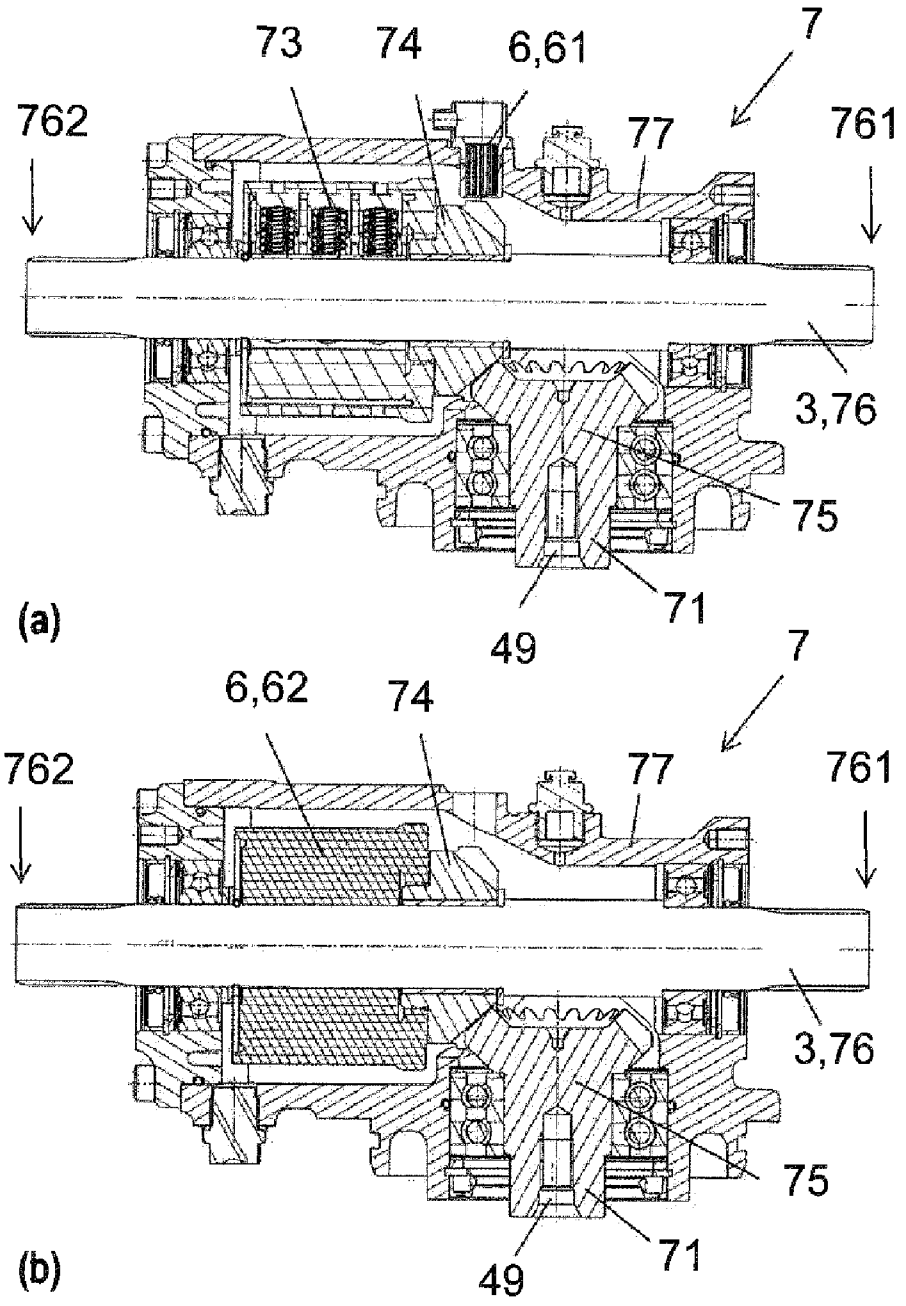

73
74
6,61
7
762
77
761
3,76
75
71
49
(a)
6,62
74
7
762
77
761
3,76
75
71
49
(b)

Fig. 3