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(54) **SEDUM SLAB HARVESTER**

(57) In an aspect a sedum slab harvester (10) for harvesting sedum substrate from the ground comprises

a first cutting unit (30) configured for cutting at least one longitudinal edge (24) of a strip (36) of sedum substrate;

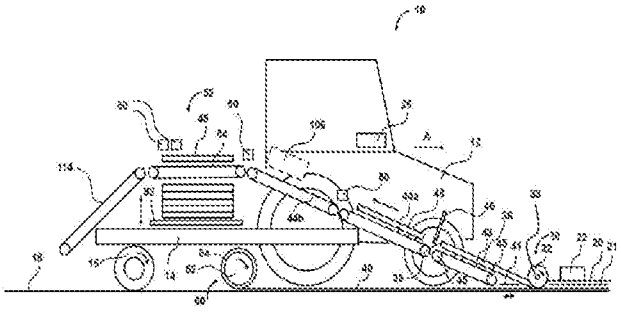
a separation head (41) configured for separating the strip (36) of sedum substrate from the ground (18);

a first conveyor system (42) configured for receiving and conveying the strip (36) of sedum substrate separated from the ground (18) by the separation head (41);

a second cutting unit (46) arranged at the downstream end of the first conveyor system (42) and configured for cutting slabs (48) of sedum substrate from the strip (36) of sedum substrate;

a second conveyor system (44) arranged downstream of the second cutting unit (46) and configured for receiving and conveying the strip (36) of sedum substrate and cut s|abs (48) of sedum substrate;

a stacking unit (52) configured for stacking cut slabs (48) of sedum substrate received from the second conveyor system.



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# SEDUM SLAB HARVESTER

The present invention relates to a sedum slab harvester for harvesting sedum substrate slabs from the ground, such as a field of cultured sedum.

In recent times increasing attention has been paid to greening the living environment in view of sustainability. One of the aspects thereof concerns the provision of a vegetation layer of living plants like one or more sedum species, a succulent, on parts of buildings, such as roofs. Benefits of this vegetation layer include inter alia protection of the roof from UV radiation thereby improving the (roof) service life, a habitat for animals, like birds and insects, thereby increasing biodiversity, air purification thereby improving the urban air quality and water retention thereby improving control of run off rain water, heat and sound insulation, and low maintenance costs. Sedum combined with its substrate (hereinafter 'sedum substrate') is commercially available in various forms such as flat mats, rolled strips and in trays,.

Sedum for commercial supply is typically grown in the open field and harvested manually. Sedum differs from turf in that inter alia the root structure of sedum is more loose making the sedum substrate vulnerable, sedum is typically grown on a mixed substrate of earth and additives, for example coconut (husk), in which substrate usually a plastic netting as a reinforcement is incorporated, instead of only soil. Typically, also a (plastic) separation foil is arranged on the bare earth, on which the sedum in the mixed substrate is to be grown. These differences complicate harvesting, transport and handling of sedum substrate compared to turf. A known alternative is culturing sedum in trays, filled with a suitable substrate, on an open field. The trays provide a rigid carrier for the sedum substrate, thereby increasing handling. However, growing itself as the trays need to be regularly arranged on the field and after growth collecting of the trays are laborious processes and therefore increase the total costs.

Sod harvesters for harvesting turf in rolled or flat shape are known. A known type of sod harvester commercially available from the present applicant for harvesting turf while moving at a constant speed over a turf field, first provides parallel longitudinal cuts by coulter discs in the turf field and then a transverse cut by a falling knife. The slab thus cut from the turf field is separated from the ground and received by an inclined conveyor, which transports the slab to a stacking unit. The harvester may be provided with a tool for winding a flat slab into a rolled shape. The stacking unit picks up one or more slabs and stacks them on a transport carrier like a pallet. Once the transport carrier is fully loaded, the carrier is put on the field, collected and transported further, while an empty carrier is reloaded into the stacking unit either by hand or automatically by a carrier injector from a carrier storage present on the sod harvester.

However, it has appeared that known sod harvesters for mechanically harvesting turf as rolled or flat slabs in open field cultivation are not suitable for harvesting sedum substrate in the same way, mainly as a result of the higher vulnerability due to the difference in substrate and the root structure between sedum and turf, the possible presence of a reinforcing netting and/or the frequent presence of a plastic separation foil.

In particular it has appeared that the transverse cut made by the falling knife necessary to cut a strip of sedum substrate in the width direction may be incomplete due to the root structure of sedum and the reinforcing netting, as a result of which a cut slab may have frayed edges, in particular front and rear edges, and inappropriate dimensions resulting in reduced quality, or even a cut slab may be not fully separated from the longitudinally cut strip and remain partly connected to the strip. In addition to the inevitable final rejection of a slab having inappropriate dimensions or quality, further processing such as stacking by the harvester is impeded, and disruptions in the harvesting process and in the operation of the harvester may occur.

Furthermore, if a plastic separation foil is present, transverse cutting a slab of sedum substrate, while it is in contact with the foil, will result in waste parts of plastic having dimensions of the slab, which waste parts need to be collected individually in order to prevent damage and contamination of the field and its environment.

In view of these difficulties in general harvesting of sedum substrate from an open field is performed manually - at least partly -, which is labour intensive, heavy, and costly.

Therefore there is a general need for a device that allows mechanical harvesting of sedum substrate slabs from an open field.

The present invention aims at solving this need or at least to provide an alternative sedum slab harvester.

In particular, the present invention aims at the provision of a sedum slab harvester that does not suffer from the above drawbacks or at least to a lesser extent.

An object of the present invention is to provide a sedum slab harvester that allows to produce a reliable transverse cut through the sedum substrate thereby ensuring the cut sedum substrate slabs to possess appropriate dimensions thereby improving quality.

Another object is to provide a sedum slab harvester that allows to process vulnerable slabs with a reduced risk of damaging.

Yet another object of the invention is to provide a sedum slab harvester that allows to stack cut slabs, while maintaining the integrity of the vulnerable slabs.

Still another further object of the invention is to provide a sedum slab harvester that allows to collect the separation foil.

A further object of the invention is to provide a sedum slab harvester, wherein the various operations of its components are controlled and synchronized with the movement speed of the harvester over the field.

Yet another object of the invention is to provide a sedum slab harvester that allows to monitor at least one dimension of the cut slab in order to control its size.

According to a first aspect, the invention provides a sedum slab harvester as defined in claim 1.

The sedum slab harvester according to this first aspect of the invention generally comprises a frame provided with one or more supporting wheels, which frame is mounted, e.g. (fixedly/releasably) coupled, to a driven vehicle, such as a tractor or other agricultural device. In an alternative embodiment the sedum slab harvester may have its own wheeled chassis, driver's cab and drive for moving around a field. A first cutting unit is configured for cutting at least one longitudinal edge, typically both longitudinal edges, of the strip to be formed from the field of sedum substrate. A separation head downstream of the first cutting unit is configured for separating the longitudinally cut strip from the ground, and if present, also from the separation foil, that remains on the ground. A first conveyor system, typically at least one upwardly inclined endless conveyor with respect to the horizontal ground, receives the separated strip and conveys it to a second conveyor system, typically comprising one or more endless conveyors also at least partly arranged at an inclined angle. At the transfer position from the first conveyor system to the second conveyor system, thus at the downstream end of the first conveyor system, a second cutting unit is provided, which second cutting unit is configured for cutting the strip in a direction transverse to the longitudinal direction of the strip, in particular once a predetermined length of strip has passed, to produce a cut slab of sedum substrate. The slab cut from the strip is advanced by the second conveyor system to a stacking unit, which is configured for receiving the cut slabs from the second conveyor system and stacking thereof on a suitable transport carrier, such as a pallet.

According to the invention the second cutting unit that is arranged at the transfer position between the first conveyor system and the second conveyor system, comprises a cutter frame to which a plurality of adjacent circular cutting elements are mounted such that these are rotatable in a direction parallel to the transverse direction. In other words the axes of rotation of these cutting elements are parallel to the conveyance direction of the first and second conveyor systems. The plurality of cutting elements preferably extend almost the full width of the strip or even beyond the longitudinal strip edges. Typically the cutting elements are oriented perpendicular to the supporting faces of the first conveyor system and the second conveyor system. The cutting elements are mounted to the cutter frame, allowing movement of the cutting elements in a first (transverse to the conveying direction) direction while contacting the strip, such that a strip can be cut over its full width from one longitudinal

edge thereof to the other parallel longitudinal edge of the strip by the simultaneous operation of the cutting elements. The cutting elements are also mounted to the cutter frame allowing movement in a second direction, opposite to the first direction, at a height above the first conveyor system and the second conveyor system without contacting the strip of sedum substrate by the cutting elements, such that an advancing strip end can pass freely below the cutting elements, until a next cutting operation of the second cutting unit.

By having a plurality of cutting elements in a side by side arrangement in the transverse direction, preferably extending over essentially the full width or beyond, only a limited movement in the first (transverse) direction, e.g. in the order of half the diameter in case of circular cutting elements, is necessary to establish a complete transverse cut through the strip of sedum substrate. This limited transverse movement requires less time to complete the transverse cut compared to a single cutting element of same dimensions (e.g. same diameter). This is important as the strip is continuously supplied by the first conveyor system to the position of the second cutting unit. For productivity, the transverse cutting operation should have a short duration, otherwise the cutting elements would block the continuously fed strip that as a result of the obstructing cutting elements would wrinkle and fold, most times upwardly, which deforms the sedum substrate and/or provide an oblique transverse cut, as has appeared upon using a single cutting element. Wrinkling and/or folding involves the risk of damaging, tearing or even breaking of the sedum substrate, thereby deteriorating the slab integrity and/or shape and as a result decreasing manipulability and/or quality thereof. A single rotating cutting element that has to move in the first transverse direction over the full width in order to provide the transverse cut would also require more time thereby necessitating a slower speed (or temporarily halting) of the first conveyor system and thus of the towing vehicle, and thus the harvesting capacity would be seriously affected. The cutter frame of the second cutting unit is also configured for moving in the upward direction with respect to the first conveyor system and second conveyor system in order to allow free passage of the strip beneath the cutting elements. During harvesting the rotating cutting elements perform a cyclic movement in the transverse and height direction. Additionally, the transverse cutting operation by the second cutting unit is performed on the strip at a position, where the strip has been separated from the separation foil, if any, so that the separation foil cannot be cut to pieces by the second cutting unit, which pieces would need to be collected separately. In the invention, such cut foil pieces cannot disturb the operation of the harvester, e.g. getting stuck in one of the conveyors and/or second cutting unit. Therefore the sedum harvester according to this aspect of the invention provides for a safe and reliable operation thereof in mechanically harvesting of sedum substrate slabs from a culturing area, such as an open field.

In an embodiment of the second cutting unit the plurality of driven cutting elements are mounted on a movable cutting unit subframe, that is movably mounted to a fixed cutting unit subframe. The movable subframe is displaceable in the first and second direction, as well as in the height direction, with respect to the fixed subframe. Preferably, the second unit comprises two movably configured subframes: a first subframe configured to be movable in the height direction with respect to a fixed subframe, a second subframe to which the cutting elements are mounted, configured to be movable in the transverse direction with respect to the first subframe.

Driving of the movable cutting unit subframe(s) may be accomplished by a suitable drive, such as a rack-and-pinion system or electric driven carriage to which the subframe(s) is (are) mounted. In a preferred embodiment the movable cutting unit subframe(s) are movably mounted by one or more piston cylinder assemblies configured for moving a movable subframe in the first and second direction and configured for moving a movable subframe in the height direction respectively. In an embodiment thereof the piston cylinder assemblies may be hydraulic assemblies.

In an embodiment the cutting elements are configured for co-rotation in the first direction of the subframe. Preferably each cutting element has its own drive, each of which is synchronously driven in a controlled manner.

In an embodiment the cutting elements are circular blades provided with a diamond cutting edge at the circumference of the blades.

The sedum slab harvester comprises a stacking unit that is configured for stacking cut slabs of sedum substrate received from the second conveyor system in one or more stacks. Prior to stacking, the slab of sedum substrate may be rolled into a roll, e.g. using a rolling device arranged at the downstream end of the second conveyor system. Such rolling devices are known per se from harvesters configured for harvesting turf in rolled shape and can be used for rolling a sedum substrate slab in a roll.

Sod harvesters for harvesting turf having a stacking unit for stacking sods in rolled shape (rolls) or in a flat shape (mats), e.g. comprising a lifting gripper provided with hooks or teeth to insert in one or more rolls or one or more flat mats, are known. Such known stacking units may be used in the sedum slab harvester according to the first aspect of the invention to transfer one or more slabs of sedum substrate, either in rolled shape or flat shape, from the conveying system to a transport carrier, on which the rolls or mats are stacked.

Engaging a slab of sedum substrate from above by such a lifting gripper and lifting it, despite the presence of a reinforcing netting in the sedum substrate, may cause sagging and due to its less solid structure also tearing, in particular in case of stacking the slabs as flat mats. This risk is even more pronounced, when the lifting gripper is operated to drop the one or more

rolled slabs or the one or more mats from a certain height on the rolls or mats already stacked on the transport carrier.

In order to retain the structural integrity of a slab of sedum during stacking in an aspect of the invention the stacking unit comprises a stacking conveyor, preferably horizontally arranged, configured for receiving and conveying thereof a cut slab of sedum substrate (either a rolled slab or a flat mat) from the second conveyor system, a slab support configured for movement in a direction transverse to the conveying direction of the stacking conveyor, a gripper system configured for gripping from above a cut slab from the stacking conveyor and transferring the cut slab onto the slab support and configured for transferring the cut slab from the slab support to a collection carrier, and a collection carrier positioned below the gripper system and configured for receiving cut slabs from the slab support in a stack arrangement. By supporting the cut slab from below by the slab support during transfer from the stacking conveyor to the collection carrier sagging is suppressed and as a result the risk of damaging the sedum substrate slab is reduced.

In an embodiment the slab support may be an endless belt conveyor.

In an embodiment the stacking unit comprises a stacking frame having frame beams extending from the stacking conveyor in a direction transverse to the conveyance direction of the stacking conveyor, a slab support plate movably supported by the frame beams and configured for reciprocating movement in a direction transverse to the movement direction of the stacking conveyor between a loading position, wherein the gripper system slides a cut sedum substrate slab from the stacking conveyor onto the slab support plate, and an unloading position, wherein the gripper system slides the cut sedum substrate slab from the slab support plate onto the collection carrier. Advantageously in the loading position the slab support plate extends beneath the stacking conveyor, in particular beneath the upper conveying part of an endless conveyor belt as stacking conveyor and above the return part thereof. By arranging the slab support plate essentially at the height of the stacking conveyor, the difference in height between the stacking conveyor and the slab support plate is kept small.

In an embodiment the gripper system may comprise a gripper, which is configured for movement in a direction transverse to the conveying direction of the stacking conveyor, e.g. fixed to the slab support plate or also movably arranged on the stacking frame beams.

In an embodiment the gripper system comprises a gripper having an extendable gripping arm, e.g. telescopically arranged arms or hinged arms, wherein the gripper is mounted at a fixed position of the harvester, e.g. at the lateral side of the collection carrier opposite the stacking conveyor.

In another embodiment the gripper system comprises a first gripper, mounted on the slab support plate, and configured for moving in a direction transverse to the movement direction

of the stacking conveyor, for gripping from above a cut slab from the stacking conveyor and transferring it to the slab support plate, a second gripper, mounted on the harvester, e.g. at the end of the frame beams opposite to the stacking conveyor, at a fixed position, and configured for gripping from above a cut slab from the slab support plate. In this embodiment, the first gripper engages the slab from above and by moving the first gripper in the transverse direction to the conveying direction of the stacking conveyor the slab is forced to slide from the stacking conveyor onto the slab support plate. The slab support plate is essentially arranged at the height of the stacking conveyor, such that the difference in height between the stacking conveyor and the slab support plate is kept small. Preferably in the loading position the slab support plate extends beneath the upper conveying part of an endless stacking conveyor. Next the slab support plate loaded with the cut slab moves along the frame beams to a position above the collection carrier, e.g. loaded with a transport carrier such as a pallet. The first gripper may be arranged to move simultaneously with the slab support for continued holding the cut slab on the slab support.

At an unloading position above the collection carrier, and when the first gripper has released the cut slab on the slab support plate, the second gripper is operated to engage the slab. Next the slab support plate is returned to its loading position at the stacking conveyor, thereby sliding the slab hold by the second gripper from the slab support on top of the collection carrier or on top of the slabs already present on the collection carrier. The cycle is repeated on a new slab that has arrived on the stacking conveyor.

Due to the sliding movements and supported transfer by the slab support from the stacking conveyor to the collection carrier the risk of damaging the vulnerable slabs is reduced, thereby ensuring the structural integrity thereof and thus slab quality.

In an embodiment the second gripper may be movably mounted to the frame beams, which is beneficial if the cut slabs are to be mounted in two or more stacks on the collection carrier. The slab support plate may be slidingly arranged on the beams or supported by wheels. The driving mechanism for reciprocating movement of the slab support plate and/or the first gripper and/or second gripper may comprise a (pneumatic) piston cylinder assembly, a rack pinion system, a chain or belt drive and the like.

The collection means typically is provided with a support for a transport carrier, such as a pallet, which support is displaceable in the height direction, such that the top of the uppermost stacked mat or roll can be maintained at a predetermined level with respect to the slab support, allowing to keep the height difference between the top of the slab support and the top of the uppermost stacked mat or roll small and thus an easy sliding transfer.

In an embodiment the sedum slab harvester also comprises a transport carrier injector, configured for discharging a loaded transport carrier such as a pallet onto the ground and reloading an empty transport carrier from a transport carrier storage on the sedum slab

harvester, in particular the collection means of the stacking unit. A pallet injector is known per se from sod harvesters, e.g. those commercially available from the applicant.

In an embodiment a gripper of the gripper system, in particular the above mentioned first gripper and/or second gripper, comprises a gripper element, such as a gripper beam, extending in the conveyance direction of the stacking conveyor, configured to be movable between a gripping position for engaging the cut slab of sedum substrate and an open position, wherein there is no contact with a sedum slab (mat or roll), e.g. using a (pneumatic) piston cylinder assembly.

In order to ensure a firm grip on the mat or roll the face of a gripper element configured for engaging the cut slab from above is provided with a plurality of projections, such as pins or teeth. In the gripping position the projections are inserted to a certain extent in the mat or roll. The projections may be curved, in particular they may have a curvature according to a relatively small circle arc having a radius around the rotation axis of the gripper element for rotation between the gripping position and open position thereof and vice versa. Such curved projections, once inserted in the slab, serve to hold the slab firmly and to prevent damage, even when there is a small height difference between the stacking conveyor and the slab support and/or the slab support and the top of an already stacked slab during transfer.

In a further aspect of the invention a sedum slab harvester is provided with a foil collector, configured for collecting used (plastic) separation foil from the ground. By collecting the used separation foil, typically cut in a strip by the first cutting unit that provides at least one longitudinal cut, and once the strip of sedum substrate is removed from the separation foil, blowing away, tearing into pieces, and the like is effectively prevented. Such a foil collector, in particular a coiler, may be applied in every type of harvester that is intended for harvesting crops, plants and the like that are grown in a substrate using a separation foil between substrate and the lower underground. Thus this aspect of the invention provides a harvester, configured for harvesting a crop grown in a substrate using a separation foil, which harvester is provided with a foil collector, configured for collecting used separation foil, preferably in strip shape.

In an embodiment thereof the coiler comprises a rotatably arranged foil winding reel having a rotary axis in the traverse direction in the transverse direction with respect to the driving direction of the harvester, configured for winding the separation foil from the ground, as well as a reel drive configured for driving the foil winding reel. During forward movement of the (sedum slab) harvester the used foil is engaged by the reel on the ground and is picked up, thereby avoiding the need of separate collection thereof. Preferably, the used separation foil collector, in particular the above coiler, is comprised in the sedum slab harvester of the first aspect of the invention.

It has appeared that the stacking operation, in particular the cycle time for stacking a mat in the stacking unit, can be a limiting factor for the capacity of the sedum substrate harvester compared to the other components.. Rolls are typically wound from the slab at a position near the transfer position from the second conveyor system to the stacking conveyor, and could be buffered on the stacking conveyor, e.g. three or more, which subsequently are gripped together by the first gripper and while being supported on the slab support they are transferred to the transport carrier. For flat mats this buffering capacity of a single stacking conveyor is not available. In order to create sufficient time for a stacking cycle, the speed of the second conveyor system may be temporarily increased compared to the speed of the first conveyor system, thereby spacing apart a cut slab from the leading edge of the strip. This increase in speed will also flatten any folds that have occurred in the strip due to hold-up of the leading edge when executing the traverse cutting operation by the second cutting unit.
Generally the first conveyor system will comprise a single conveyor. Typically the conveyors of the first conveyor system, the second conveyor system and the stacking conveyor are endless belt conveyors. The belt itself may be composed of a plurality of relatively small belts in a side by side arrangement. The conveying surface may be provided with tiny projections for extra grip on the sedum substrate strip and/or slab.
In an embodiment of the sedum slab harvester according to the invention the second conveyor system comprises at least two subconveyors in series, configured for establishing a distance between cut slabs of sedum substrate from the second cutting unit to the stacking unit. The second conveyor system according to this embodiment allows the spacing between slabs in the sedum slab harvester to be established in a controlled manner. Because of the controlled spacing, the stacking unit can be used to pick up a cut slab from the stacking conveyor and stack it on the collection carrier of the stacking unit, before a subsequent cut slab arrives at the stacking conveyor from the second conveyor system.
A controller is configured for controlling the operation of the actively controlled harvester components based on signals received from one or more sensors, configured for detecting the presence and/or position of a sedum substrate strip end and/or a cut slab of sedum substrate on the second conveyor system and the stacking unit.
Typically the actively operated components, including first conveyor system, second cutting unit, second conveyor system, stacking unit, optional separation foil collecting means, of the sedum slab harvester are controlled by the controller, depending on the forward speed of the harvester, such as the towing vehicle.
Typically the controller is configured for setting a constant speed of the harvester, and for coordinating the operation of the other components, in particular the speed of the first conveyor system, cyclic movement of the second cutting unit, speeds of the subconveyors of

the second conveyor system, and the stacking unit, e.g. the speed of the stacking conveyor and operation of the gripper system and slab support.

In an embodiment the sensors configured for detecting the presence of the strip end or slab in the harvester are typically positioned at least at the transfer from the first subconveyor to the second subconveyor of the second conveyor system, at the transfer from the second subconveyor of the second conveyor system to the stacking conveyor, and at the downstream end of the stacking conveyor.

In an embodiment two such sensors, spaced apart e.g. about 10-30 cm, such as 20 cm, in the conveying direction, are positioned at the downstream end of the stacking conveyor. The upstream sensor thereof initiates a controlled deceleration thereby allowing to more accurately position the cut slab on the stacking conveyor upon halting the stacking conveyor, which halting is triggered by the second downstream sensor. Alternatively a sensor sensing the absence of a slab at the transfer position from the second conveyor to the stacking conveyor can trigger the controlled deceleration.

Generally the controller is configured to drive the first conveyor system at a speed equal to the forward speed of the sedum slab harvester over the ground, and to drive the second conveyor system and stacking unit in order to establish a spacing between cut slabs on the second conveyor system by performing a cycle of accelerating and decelerating the subconveyors of the second conveyor system and the stacking conveyor.

E.g. the first subconveyor of the second conveyor system is driven at an increased speed such as three times the speed of the first conveyor system. Upon sensing the leading edge of the strip at the transfer position of the first subconveyor to the second subconveyor the speed of the first subconveyor is decelerated to the speed of the first conveyor system. The cutting operation by the second unit is performed on the sedum substrate strip thereby producing a sedum substrate slab. Directly after the second unit has performed its cutting movement in the first direction, the first subconveyor is accelerated to the increased speed, even if the cutting elements are not yet raised. A little hold up of the new leading end of the strip by the lowered cutting elements may occur. When the cutting elements are raised, this hold up is compensated by the increased speed of the first subconveyor and the strip is flattened. During further conveyance the new strip end will slip on the first subconveyor, until the new leading end of the strip is detected by the sensor at the transfer position of the first subconveyor to the second subconveyor. This subcycle of adjusting the speed of the first subconveyor and driving of the second cutting unit is repeated continuously.

The second subconveyor is driven at the increased speed of the first subconveyor of the second conveyor system. Upon sensing the front end of the slab by the sensor at the transfer position of the second subconveyor to the stacking conveyor of the stacking unit, the second subconveyor is decelerated to an intermediate speed in between the increased speed and the

speed of the first conveyor, such as two times the speed of the first conveyor. Upon sensing the rear end of the cut sedum substrate slab by the sensor at the transfer position of the second subconveyor to the stacking conveyor of the stacking unit, the second subconveyor is accelerated to the increased speed until the front end of a subsequent slab is detected at the sensor at the transfer position of the second subconveyor to the stacking conveyor. This subcycle of the second conveyor is repeated continuously.

The stacking conveyor of the stacking unit is driven at the intermediate speed. Upon sensing the front end of the slab by the upstream sensor of the two sensors at the downstream end of the stacking conveyor, the speed of the stacking conveyor is decelerated to a slow speed such as half the speed of the first conveyor system. Upon sensing the front end of the slab by the downstream sensor of the two sensors at the downstream end of the stacking conveyor, the speed of the stacking conveyor is decelerated to zero and the stacking conveyor is halted. The slab is transferred from the stacking conveyor to the collection means by the gripper system. Upon removal of the slab from the stacking conveyor, the stacking conveyor is accelerated to the intermediate speed. This subcycle of the stacking conveyor and grippier system is repeated continuously. Based on the speed of the respective conveyor and lapsed time from the cutting operation of the second cutting unit the sensors allow to determine the length of the cut slab, and if its calculated length is outside a predetermined range to reject that slab. For rejection purposes a further reject conveyor may be provided adjacent the downstream end of the stacking conveyor, configured for receiving a slab to be rejected from the stacking conveyor and discharging thereof, e.g. on the ground. If needed the reject conveyor may be used as a temporarily buffer position in case of failure or distortion of the stacking unit, e.g. the grippers, and/or transport carrier injector, if present. Thus in an embodiment the harvester comprises a reject conveyor downstream of the stacking conveyor, configured for receiving a slab of sedum substrate, wherein the controller is configured for determining a slab length from signals received from the sensors, and driving the stacking conveyor and reject conveyor if the determined slab length is outside a predefined range. E.g. the slab has a desired length of 600 -1200 mm and a width of 400 up to 800 mm. Typically the dimensions of the subconveyors of the second conveyor system and the stacking conveyor of the stacking unit are adapted to the size of the slab.

It will be clear that the aspects of a foil collector, configured for collecting a separation foil, can be similarly applied to other types of harvesters, where a crop is cultured in the open field using a separation foil, as well as to different sedum substrate harvesters with other type(s) of conveyors, second cutting unit and/or stacking unit than the ones discussed above.

The same applies to the method and system of multiple conveyors for substrate handling (sedum, turf) that are controlled to carry out a cyclic operation of accelerating and

decelerating in order to establish spacing between subsequently conveyed slabs, in particular where the slabs are to be stacked as flat mats.

It will also be apparent that the monitoring method and system for determining the length of a cut substrate slab using sensors and rejection of slabs having a length outside a predefined range can be used for substrate slab harvesters in general.

Furthermore, the stacking unit having a support slab for transfer of a cut slab from a stacking conveyor to a collection carrier, as described above, can be used for any type of substrate of a crop, wherein careful handling of a vulnerable substrate is needed. This stacking unit can also be used for handling trays, wherein a crop substrate is grown in trays arranged on the field. In that case the first and second cutting units for cutting a strip longitudinally and in in transverse direction, and separation head, are omitted.

The invention is further illustrated by means of the attached drawing, wherein:

Fig. 1 diagrammatically shows an embodiment of a sedum slab harvester according to the invention in side view;

Fig. 2 diagrammatically shows the embodiment of a sedum slab harvester of Fig. 1 – at least partially - in top view;

Fig. 3 diagrammatically shows an embodiment of a second cutting unit of a sedum slab harvester according to the invention in more detail; and

Fig. 4 diagrammatically shows an embodiment of a stacking unit of a slab sedum harvester according to the invention.

In Fig. 1 and Fig. 2 an embodiment of a sedum harvester according to the invention is shown diagrammatically in side view and top view respectively. The sedum harvester is generally indicated by reference numeral 10 and is mounted to a towing vehicle 12, such as a tractor or other agricultural vehicle. The sedum harvester 10 comprises a frame, shown in a simplified manner by beam 14, provided with one or more wheels 16, which frame 14 carries the various operational units of the sedum harvester 10. In this embodiment the harvester 10 mounted to the vehicle 12, extends at least partially along a lateral side of the vehicle 12. In the situation shown, the vehicle 12 rides in a forward driving direction (indicated by arrow A) on bare ground 18, from which sedum substrate 20 comprising reinforcing netting 21 has already been collected. Similarly the supporting wheels 16 ride on the bare ground 18. Thereby damage to the sedum substrate 20 to be harvested can be avoided. At the front end of the harvester a guide 22 is provided, which is configured to follow an already cut longitudinal edge 24 (see Fig. 2) of the sedum substrate 20 to be collected. The guide 22 comprises for example a proximity sensor or a contact sensor (not shown), a signal of which is processed in a controller 26 which steers the vehicle 12 at a predetermined speed along the field. A first cutting unit 30 comprising two knives 32, e.g. coulter discs, rotatably arranged on a horizontal rotation axis 33 transverse to the driving direction of the harvester, that are

configured to cut the longitudinal edges 34 of the strip 36 of sedum substrate thus formed in a predetermined width. The front end 38 of the strip 36 is separated from the ground 18 and a separation foil 40, if present, by a separator head 41, such as an reciprocating (oscillating) plate having a lower plate face essentially parallel to the ground 18, and then taken up by a first conveyor system 42. In the embodiment shown the first conveyor system 42 comprises an endless conveyor belt 43 having multiple, in this case four, endless belts 43', that are spaced apart arranged parallel to one another, and two rolls 45, at least one of which is driven by a motor (not shown) controlled by the controller 26. Typically in operation the speed of the vehicle 12 and the first conveyor system 42 are maintained at the same speed in order to avoid pull on the strip 36 of sedum substrate, which would occur if the first conveyor system speed is higher than the speed of the vehicle 12 and/or to avoid accumulation of the separated strip 36 on the first conveyor system, if the speed thereof would be lower than the speed of the vehicle 12. The sedum slab harvester 10 may be provided with a sensor (not shown), e.g. at the guide 22, that measures the (forward) speed of the harvester. The first conveyor system 42 is upwardly inclined with respect to the ground 18, such that the strip 36 is conveyed to a higher level. At the downstream (upper) end of the first conveyor system 42 a second conveyor system 44 is arranged, that is configured for receiving the strip 36 from the first conveyor system 42. At the transfer position from the first conveyor system 42 to the second conveyor system 44 a second cutting unit 46 is positioned, that is configured for cutting a transverse cut in the strip 36 once a sufficient length of strip 36, typically determined by sensors 50, has passed beneath its cutting element/ The length may also be determined,. based on the known speed of the first conveyor system 42 and/or second conveyor system 44 and the time lapsed after the preceding cut.

An embodiment of a second cutting unit 46 is shown in Fig. 3 and is described in more detail hereinbelow. A slab 48 thus cut from the strip 36 is advanced by the second conveyor system 44. In the embodiment shown the second conveyor system 44 comprises a first subconveyor 44a and a second subconveyor 44b, The second conveyor system 44, in particular the individual speeds of the subconveyors 44a and 44b, is cyclically controlled, such that after the transverse cutting operation of the second cutting unit 46, a spacing between the rear end of the cut slab 48 and the leading end 38 of the strip 36 and thus the leading end of the subsequent slab to be cut, is established. In addition temporarily increasing the speed of the conveyor system 44, e.g. subconveyor 44a, causes the leading end of the strip 36 to be stretched in the forward direction thereby flattening the strip if during the cutting operation of the second cutting unit 46 any hold-up causing wrinkles or folds has occurred. Sensors 50, configured for detecting the presence (e.g. contact switches) and/or position of sedum substrate, are typically arranged at the transfer position of the subconveyor 44a to the subconveyor 44b, at the transfer position of the second subconveyor 44b to a stacking unit

52, and at the downstream end of a stacking unit 52, in particular two spaced apart sensors at the downstream end of a stacking conveyor 54 of stacking unit 52. Generally, subconveyors 44a and 44b and stacking conveyor 54 have a similar configuration as the first conveyor belt 43. Thus the conveyors of the sedum slab harvester 10 are generally comprised of a plurality of parallel endless belts as illustrated for the first conveyor belt 43. The speed of the stacking conveyor 54 is controlled to be similar to that of the subconveyor 44b upon transfer of a slab 48 from the subconveyor 44b to the stacking conveyor 54. During the stacking operation described below the stacking conveyor 54 is halted.

Foil 40, if present, from which the sedum substrate has been removed, will typically have been longitudinally cut into a strip by the knives 32. The embodiment of a harvester 10 as shown in Fig. 1 and 2, comprises a foil collector 60. As shown, the foil strip 40 is wound on a reel 62 contacting the separation foil 40 on the ground 18 and thereby removed therefrom. The outer circumferential surface 64 of the reel 62 will typically have means for taking up the foil 40. Suitable examples thereof comprise a pressure sensitive adhesive, a temporary adhesive, mechanical holding means like pointed projections like needles or other types of projections projecting outwardly from said surface. Once the reel 62 is full with wound foil, it can be removed and substituted by a fresh empty reel. The reel 62 may be driven by rolling over the ground 18 caused by the forward movement of the harvester 10. Alternatively, the reel 62 may have its own drive (not shown).

An embodiment of a second cutting unit 46 is shown in more detail in Fig. 3. In fig. 3 the second cutting unit 46 comprises a cutter frame 70 mounted on the general frame of the harvester 10. The cutter frame 70 carries a first subframe 72, which on its turn carries a second subframe 73. In this embodiment multiple discs 74 having a diamond cutting edge (not separately shown) at their circumference are mounted on the subframe 73 adjacent to one another, such that in this embodiment (seen in projection from above) they cover the width of the strip 36. Typically the blades of the discs 74 do not overlap one another in order to make a clean cut in the strip 36 having a reinforcing netting 21. A disc 74 is rotatable about a rotation axis 76 that is arranged parallel to the conveying direction of the strip 36 to be cut. Typically the multiple discs 74 are each synchronously driven by their own drive 75 under control of the controller 26. The subframe 72 is movable, such as slidingly arranged in vertical guides 78, with respect to the fixed frame 70 in the height direction in order to allow free passage of the leading end 38 of the strip 36 underneath the discs 74 by means of a first piston cylinder assembly 76, mounted on rotary axes 77. A second piston cylinder assembly 80, mounted on rotary axes 81, allows to move, e.g. sliding in horizontal guides 79, the subframe 73 in the transverse direction for providing the transverse cut in the strip 36. During passage of the leading end of the strip 36 below the discs 74 the subframes 72 and 73 return back to its starting position.

The stacking operation is performed on a slab 48, present on the stacking conveyor 54.of stacking unit 52, of which an embodiment is shown in Fig. 4. The stacking unit 52 mounted on the general frame of the sedum harvester 10 comprises a stacking unit frame 82, of which two beams 84 (only one visible) extend from the stacking conveyor 54 in a direction transverse to the conveying direction of the stacking conveyor 54. A slab support, such as a slab support plate 86, is movably, for example slidingly arranged, on the beams 84 between a loading position L and an unloading position U . A first gripper 88 is mounted on the slab support plate 86 and thus movable therewith. The slab support plate 86 extends beneath the upper conveying part of the stacking conveyor in the loading position. At the opposite end of the beams 84 a second gripper 90 is – in this embodiment fixedly – mounted on frame 82. The first gripper is configured for pulling a slab 48 from the stacking conveyor 54 onto the slab support plate 86 by movement of the slab support plate 86. The second gripper 90 is configured for pulling the slab 48 from the slab support plate 86 onto a transport carrier 92 such as a pallet, by return movement of the slab support plate 86. In the embodiment shown, the first gripper 88 comprises a hinged beam 94 driven by a piston cylinder assembly 95, rotatably mounted on rotary axes 97, provided with projections 96. The beam 94 can be rotated about axis 93 between a gripping position as shown in contact with the slab 48 and a non-working position (compare the open position of the second gripper 90) out of engagement with the slab. The second gripper 90 is similarly configured and in the embodiment shown comprises a hinged beam 98 having projections 100, driven by a piston cylinder assembly 99, rotatably mounted on rotary axes 101 and can be rotated between a gripping position in contact with the slab 48 and a non-working position out of contact with the slab. Upon movement of the slab support plate 86 and the first gripper 88 on the beams 84 while engaging a slab 48 on the stacking conveyor 54 and having the projections 96 inserted in the slab 48 to some extent, the first gripper 88 draws the slab 48 from the stacking conveyor 54 onto the slab support plate 86. Thus the slab 48 is conveyed to an unloading (stacking) position lateral from the stacking conveyor 54. Upon arrival at the unloading position the slab 48 is released from the first gripper 88 and the second gripper 90 is actuated to engage the slab 48 on the slab support 86. Upon movement of the slab support 86 back to the position at the stacking conveyor 54 the slab 48 held by the second gripper 90 is slidingly removed from the slab support 86 and positioned on top of any slabs 48 already present on the transport carrier 92. The transport carrier 92 itself is typically supported on a supporting frame 102 of collection carrier 105, of which the supporting arms 104 can be adjusted in height, such that the top of the uppermost slab on the packaging carrier 92 can be set to the height of the slab support 86. The height adjustment may be controlled based on signals of a height sensor configured for determining the height of the top surface. Thereby the transfer of a slab 48 from the stacking conveyor 54 to the packaging carrier 92 is performed, while the

slab 48 is supported from below during lateral movement from the loading position at the stacking conveyor 54 to the unloading position at the transport carrier 92.

While the stacking operation has been described with respect to a flat slab, also one or more rolled slabs can be easily, if applicable simultaneously, removed from the stacking conveyor 54 to the transport carrier 92. Rolling of a slab of sedum substrate can be performed on the second conveyor system prior to transfer to the stacking conveyor 54, e.g. using a winding device known per se from turf sod harvesters. Such a winding device 106 has been depicted in Fig. 1 in dashed lines.

The sedum slab harvester 10 can be provided with a storage 108 (see Fig. 2) for storing a plurality of transport carriers. The storage 108 may have a storage frame 110, configured for carrying a plurality of empty transport carriers 92, which frame is hinged connected to the frame 14 of the sedum slab harvester 10 about a vertical axis 112, at the rear (seen in driving direction of the harvester 10) end of the stacking unit 52.

If a cut slab 48 does not meet a predetermined length, based on signals from the sensors 50 and/or e.g. the controlled speed of the second conveyor system 44, the slab may be rejected via reject conveyor 114.

In the embodiment shown the second gripper is fixed. If the transport carrier has a surface large enough to collect the slabs in two stacks adjacent to one another, the second carrier can be movably arranged on the beams to a position about half the transport carrier, allowing to stack subsequent slabs received on the stacking conveyor on the two stacks in an alternating manner.

# C O N C L U S I E S

1. Sedumplak oogstmachine (10) voor het oogsten van plakken (48) sedumsubstraat van de grond (18), omvattende
een eerste snijeenheid (30) geconfigureerd voor het snijden van ten minste een langsrand (24) van een strook (36) sedumsubstraat
een scheidingskop (41) geconfigureerd voor het scheiden van de strook (36) sedumsubstraat van de grond (18);
een eerste transportsysteem (42) voor het ontvangen en transporteren van de door de scheidingskop (41) van de grond (18) gescheiden strook (36) sedumsubstraat;
een tweede snijeenheid (46) opgesteld aan het benedenstrooms einde van het eerste transportsysteem (42) en geconfigureerd om een plak (48) sedumsubstraat van de strook (36) sedumsubstraat te snijden;
een tweede transportsysteem (44), opgesteld benedenstrooms van de tweede snijeenheid (46), en geconfigureerd om de strook (36) sedumsubstraat en gesneden plakken (48) sedumsubstraat te ontvangen en te transporteren;
een stapeleenheid (52) geconfigureerd om van het tweede transportsysteem (44) ontvangen gesneden plakken (48) sedumsubstraat te stapelen;
waarbij de tweede snijeenheid (46) een snijframe (70,72, 73) omvat met meerdere aangedreven cirkelvormige snijelementen (74) die dwars op de transportrichting van de strook (36) sedumsubstraat en aangrenzend aan elkaar zijn opgesteld en die zijn geconfigureerd voor beweging in een eerste richting dwars op de transportrichting van het eerste transportsysteem (42) in snijcontact met de strook (36) sedumsubstraat, waardoor een plak (48) sedumsubstraat in de breedterichting van de strook (36) sedumsubstraat wordt gesneden en die zijn geconfigureerd om in een tweede richting, tegengesteld aan de eerste richting, beweging op een hoogte boven het eerste transportsysteem (42) en het tweede transportsysteem (44) toe te laten zonder aanraking van de strook sedumsubstraat.

2. Sedumplak oogstmachine volgens conclusie 1, waarin de meerdere aangedreven cirkelvormige snijelementen (74) van de tweede snijeenheid (46) zijn gemonteerd op ten minste één beweegbaar subframe (72; 73) van de snijeenheid, dat beweegbaar is gemonteerd op een vast subframe (70) van de snijeenheid.

3. Sedumplak oogstmachine volgens conclusie 2, waarbij een eerste beweegbaar subframe van de snijeenheid (72) beweegbaar is gemonteerd op het vaste subframe (70) van de snijeenheid met een eerste zuigercilindersamenstel (76), geconfigureerd voor het bewegen van het beweegbare subframe (72) van de snijeenheid in de hoogterichting, en een tweede beweegbaar subframe (73) van de snijeenheid beweegbaar is gemonteerd op het

eerste subframe (72) met een tweede zuigercilindersamenstel (80), geconfigureerd voor het bewegen van het beweegbare subframe (73) van de snijeenheid in de eerste en tweede richting, waarbij de snijelementen (74) zijn gemonteerd op het tweede subframe (73) .

4. Sedumplak oogstmachine volgens een van de voorgaande conclusies, waarbij de cirkelvormige snijelementen (74) geconfigureerd zijn voor co-rotatie in de eerste richting.

5. Sedumplak oogstmachine volgens een van de voorgaande conclusies, waarbij de aangedreven cirkelvormige snijelementen (74) cirkelbladen zijn voorzien van een diamanten snijrand aan de omtrek van de bladen.

6. Sedumplak oogstmachine volgens een van de voorgaande conclusies, waarbij de stapeleenheid (52) een stapeltransporteur (54) omvat die geconfigureerd is om een gesneden plak (48) sedumsubstraat van het tweede transportsysteem (44) te ontvangen en te transporteren, een plaksteun (86) geconfigureerd om te bewegen in een richting dwars op de bewegingsrichting van de stapeltransporteur (54), een grijpersysteem (88, 90) geconfigureerd om van bovenaf een gesneden plak (48) van de stapeltransporteur (54) te grijpen en de gesneden plak (48) over te brengen op de plaksteun (86) en geconfigureerd om de gesneden plak (48) van de plaksteun (86) over te brengen naar een verzameldrager (102, 104), en een verzameldrager (105), gepositioneerd onder de tweede grijper (90) en geconfigureerd om gesneden plakken (48) van de plaksteun (86) in een stapelopstelling te ontvangen.

7. Sedumplak oogstmachine volgens conclusie 6, omvattende een frame (82) met balken (84) die zich vanaf de stapeltransporteur (54) uitstrekken in een richting dwars op de transportrichting van de stapeltransporteur (54), een plaksteunplaat (86) beweegbaar ondersteund door de framebalken (84) en geconfigureerd voor een heen en weer gaande beweging in een richting dwars op de transportrichting van de stapeltransporteur (54) tussen een laadpositie, waarin het grijpersysteem (88, 90) een gesneden sedumsubstraat plak (48) van de stapeltransporteur (54) op de plaatsteun (86) schuift, en een lospositie, waarin het grijpersysteem (88, 90) de gesneden sedumsubstraat plak (48) van de plaksteunplaat (86) op de verzameldrager (105) schuift.

8. Sedumplak oogstmachine volgens conclusie 7, waarbij het grijpersysteem een eerste grijper (88) omvat, gemonteerd op de plaksteunplaat (86) en geconfigureerd voor het bewegen in een richting dwars op de transportrichting van de stapeltransporteur (54), en voor het van bovenaf grijpen van een gesneden plak (48) van de stapeltransporteur (54) en het overbrengen ervan naar de plaksteunplaat (86), een tweede grijper (90), gemonteerd op een

vaste positie, geconfigureerd voor het van bovenaf grijpen van een gesneden plak (48) van de plaksteunplaat (86).

9. Sedumplak oogstmachine volgens een van de conclusies 6 - 8, waarbij het grijpersysteem een eerste grijper (88) omvat met een grijpelement (94) dat zich in de transportrichting van de stapeltransporteur (54) uitstrekt, geconfigureerd om beweegbaar te zijn tussen een grijppositie voor het in aanraking verkeren met de gesneden plak (48) sedumsubstraat op de stapeltransporteur (54) en de plaksteunplaat (86) en een open positie, en/of een tweede grijper (90) met een grijpelement (98) dat zich in de transportrichting van de stapeltransporteur (54) uitstrekt, geconfigureerd om beweegbaar te zijn tussen een grijppositie voor het in aanraking verkeren met de gesneden plak (48) sedumsubstraat op de plaksteunplaat (86) en een open positie.

10. Sedumplak oogstmachine volgens een van de voorgaande conclusies 6-9, waarbij het oppervlak van een grijpelement (94; 98) geconfigureerd om de gesneden plak (48) aan te grijpen, voorzien is van meerdere uitsteeksels (96; 100).

11. Sedumplak oogstmachine volgens een van de voorgaande conclusies, verder omvattende een foliecollector (60), geconfigureerd voor het verzamelen van gebruikte scheidingsfolie (40) van de grond (18).

12. Sedumplak oogstmachine volgens conclusie 11, waarbij de collector (60) een draaibaar opgestelde foliewikkelrol (62) omvat met een draaias in de dwarsrichting ten opzichte van de rijrichting van de oogstmachine, geconfigureerd voor het wikkelen van de scheidingsfolie (40) van de grond (18).

13. Sedumplak oogstmachine volgens een van de voorgaande conclusies, waarbij het tweede transportsysteem (44) ten minste twee in serie geplaatste subtransporteurs (44a, 44b) omvat, geconfigureerd voor het bewerkstelligen van een afstand tussen gesneden plakken (48) sedumsubstraat vanaf de tweede snijeenheid (46) naar de stapeleenheid (52).

14. Sedumplak oogstmachine volgens een van de voorgaande conclusies, verder omvattende sensoren (50), geconfigureerd voor het detecteren van de aanwezigheid van sedumsubstraat op een of meer posities op het eerste transporteursysteem (42), het tweede transporteursysteem (44) en/of de stapeltransporteur (54).

15. Sedumplak oogstmachine volgens conclusie 14, verder omvattende een besturingsinrichting (26), geconfigureerd voor het regelen van de werking van de actief

bediende oogstmachineonderdelen, gebaseerd op signalen ontvangen van de sensoren (50), bij voorkeur ook afhankelijk van de bewegingssnelheid van de sedumplak oogstmachine (10) over de grond (18).

16. Sedumplak oogstmachine volgens conclusie 15, waarbij de besturingsinrichting (26) geconfigureerd is om het eerste transporteursysteem (42) aan te drijven met een snelheid die gelijk is aan de voorwaartse snelheid van de sedumplak oogstmachine over de grond, en om een cyclus van versnellen en vertragen van de subtransporteurs (44a, 44b) van het tweede transporteursysteem (44) uit te voeren om een afstand tussen de gesneden plakken (48) op het tweede transporteursysteem (44) te bewerkstelligen.

17. Sedumplak oogstmachine volgens een van de voorgaande conclusies, verder omvattende een afkeurtransporteur (114) benedenstrooms van de stapeleenheid (52), geconfigureerd voor het ontvangen en transporteren van een gesneden plak (48) sedumsubstraat van de stapeleenheid (52).

18. Sedumplak oogstmachine volgens conclusie 16, waarbij de besturingsinrichitng (26) geconfigureerd is om een plaklengte te bepalen uit de van de sensoren (50) ontvangen signalen, en om de stapeltransporteur (54) en afkeurtransporteur (114) aan te drijven, indien de bepaalde plaklengte buiten een vooraf bepaald bereik valt.

Fig. 1

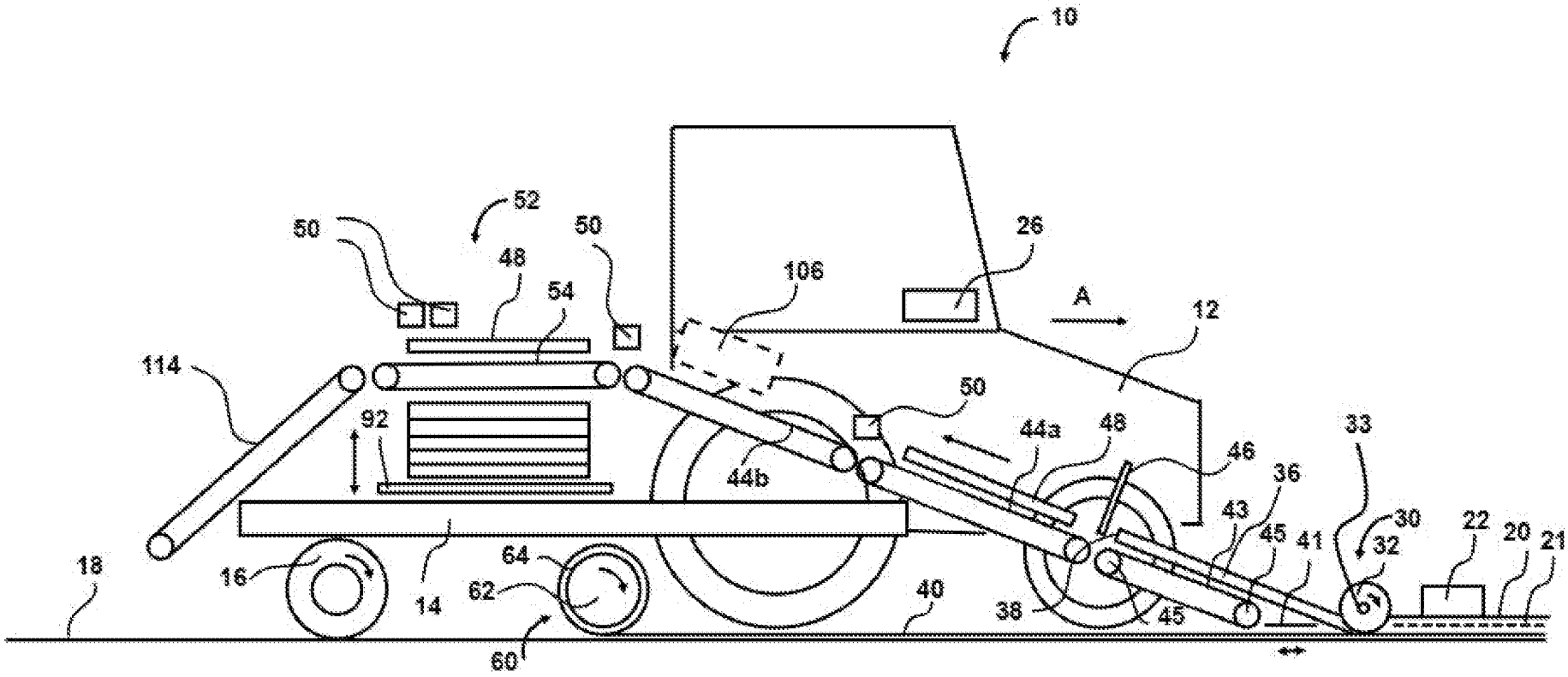
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Fig. 2

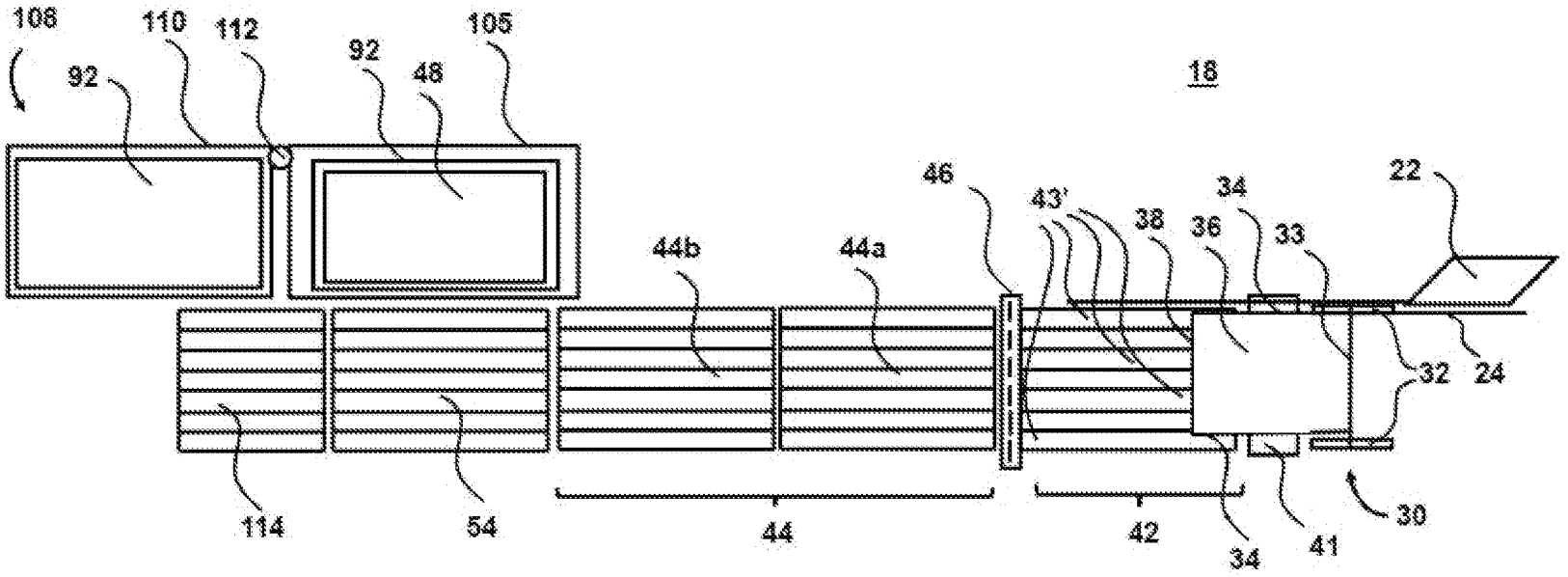
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Fig. 3

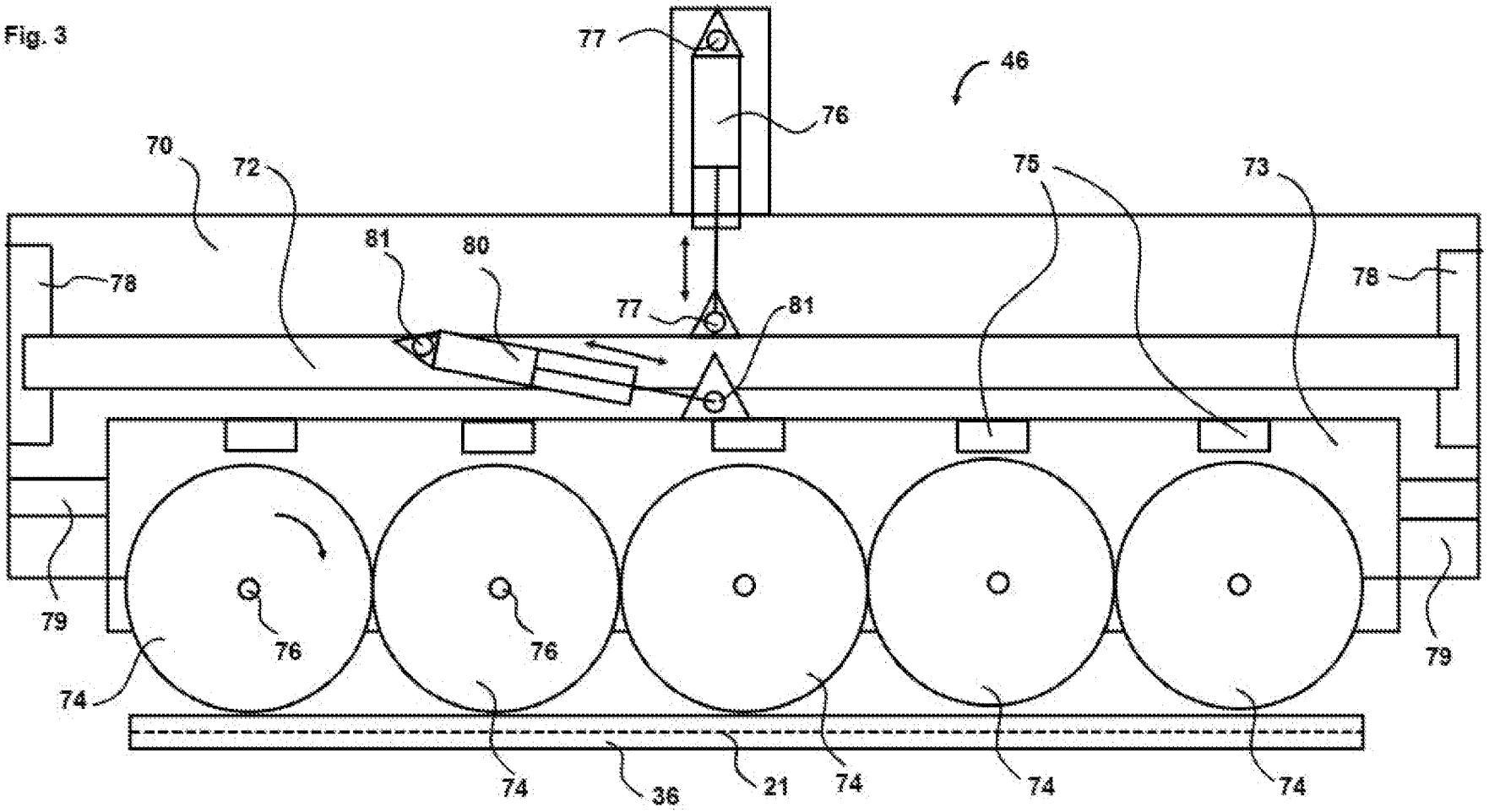
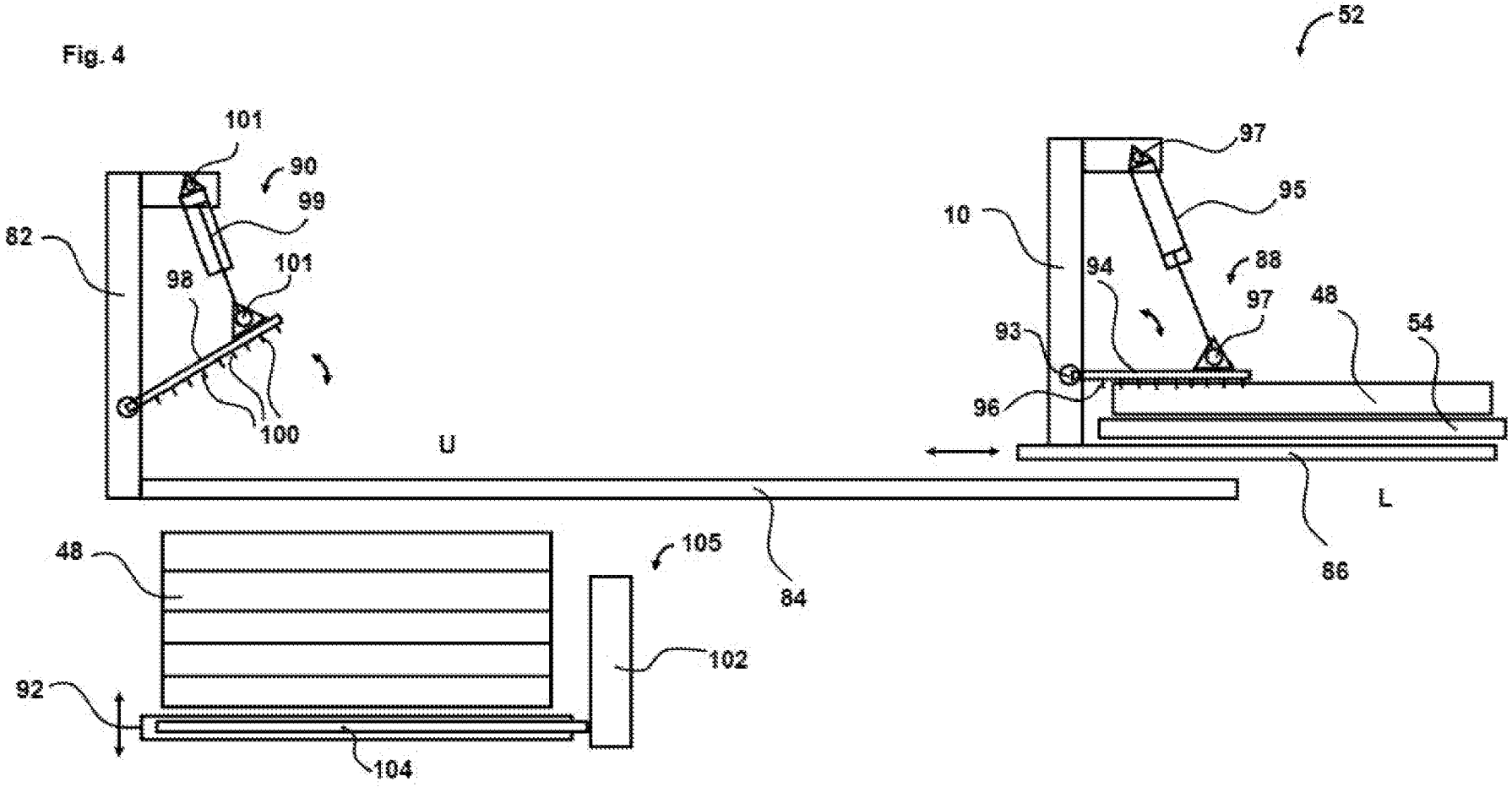


Fig. 4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# SAMENWERKINGSVERDRAG (PCT)

## RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

| IDENTIFICATIE VAN DE NATIONALE AANVRAGE | KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE |
|---|---|
| Nederlands aanvraag nr.<br>**2033645** | Indieningsdatum<br>**30-11-2022** |
| | Ingeroepen voorrangsdatum |
| Aanvrager (Naam)<br>**Van Vuuren Machines B.V.** | |
| Datum van het verzoek voor een onderzoek van internationaal type<br>**17-12-2022** | Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.<br>**SN82787** |

**I. CLASSIFICATIE VAN HET ONDERWERP** (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

**Zie onderzoeksrapport**

**II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK**

Onderzochte minimumdocumentatie

| Classificatiesysteem | Classificatiesymbolen |
|---|---|
| **IPC** | **Zie onderzoeksrapport** |

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

| | | | |
|---|---|---|---|
| **III.** | ☐ | **GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES** | (opmerkingen op aanvullingsblad) |
| **IV.** | ☐ | **GEBREK AAN EENHEID VAN UITVINDING** | (opmerkingen op aanvullingsblad) |

# ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
**NL 2033645**

A. CLASSIFICATIE VAN HET ONDERWERP
**INV. A01G20/12 A01G20/15**
**ADD.**

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte miminum documentatie (classificatie gevolgd door classificatiesymbolen)
**A01G**

Onderzochte andere documentatie dan de mimimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)
**EPO-Internal, WPI Data**

C. VAN BELANG GEACHTE DOCUMENTEN

| Categorie ° | Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages | Van belang voor conclusie nr. |
|---|---|---|
| A | WO 2006/081654 A1 (1045929 ONTARIO LTD [CA]; BROUWER GERARDUS J [CA]; MILWAIN ROBERT [CA]) 10 augustus 2006 (2006-08-10)<br>* samenvatting; figuren 1-56 *<br>* alinea [0089] - alinea [00187] *<br>----- | 1-18 |
| A | US 4 162 709 A (WILSON WOODROW L [US]) 31 juli 1979 (1979-07-31)<br>* samenvatting; figuren 1-4 *<br>* kolom 2, regel 49 - kolom 6, regel 40 *<br>* Note figure 3, element 100 as second cutting unit. *<br>----- | 1-18 |
| A | US 2017/027098 A1 (APOSHIAN STEVEN R [US] ET AL) 2 februari 2017 (2017-02-02)<br>* samenvatting; figuren 1-5 *<br>* Note figure 4, element 206 as second cutting unit. *<br>----- | 1-18 |

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[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

° Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

| Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid | Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type |
|---|---|
| **18 juli 2023** | |

| Naam en adres van de instantie | De bevoegde ambtenaar |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | **Balzar, Maarten** |

1

# ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
**NL 2033645**

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

| Categorie ° | Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages | Van belang voor conclusie nr. |
|---|---|---|
| A | US 2013/259629 A1 (APOSHIAN STEVEN R [US] ET AL) 3 oktober 2013 (2013-10-03)<br>* samenvatting; figuren 1-4 *<br>* Note figure 1, element 114 as second cutting unit *<br>* alinea [0019] - alinea [0043] *<br>----- | 1-18 |
| A | US 5 775 436 A (NOYES II THOMAS E [US] ET AL) 7 juli 1998 (1998-07-07)<br>* samenvatting; figuren 1-3 *<br>* kolom 3 - kolom 8 *<br>----- | 1 |

# ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek

**NL 2033645**

| In het rapport genoemd octrooigeschrift | Datum van publicatie | Overeenkomend(e) geschrift(en) | Datum van publicatie |
|---|---|---|---|
| WO 2006081654 A1 | 10-08-2006 | AU 2006209823 A1 | 10-08-2006 |
| | | CA 2596924 A1 | 10-08-2006 |
| | | EP 1850654 A1 | 07-11-2007 |
| | | US 2006185860 A1 | 24-08-2006 |
| | | WO 2006081654 A1 | 10-08-2006 |
| US 4162709 A | 31-07-1979 | GEEN | |
| US 2017027098 A1 | 02-02-2017 | GEEN | |
| US 2013259629 A1 | 03-10-2013 | GEEN | |
| US 5775436 A | 07-07-1998 | GEEN | |

# WRITTEN OPINION

| File No. | Filing date *(day/month/year)* | Priority date *(day/month/year)* | Application No. |
|---|---|---|---|
| SN82787 | 30.11.2022 | | NL2033645 |

International Patent Classification (IPC)
INV. A01G20/12 A01G20/15

Applicant
Van Vuuren Machines B.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the application
- ☒ Box No. VIII Certain observations on the application

| | Examiner |
|---|---|
| | Balzar, Maarten |

Application number

# WRITTEN OPINION

NL2033645

## Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the application as filed.

   b. ☐ furnished subsequent to the filing date for the purposes of search,

      ☐ accompanied by a statement to the effect that the sequence listing does not go beyond the disclosure in the application as filed.

3. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the application, this opinion has been established to the extent that a meaningful opinion could be formed without a WIPO Standard ST.26 compliant sequence listing.

4. Additional comments:

## Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|---|---|---|---|
| Novelty | Yes: | Claims | 1-18 |
| | No: | Claims | |
| Inventive step | Yes: | Claims | 1-18 |
| | No: | Claims | |
| Industrial applicability | Yes: | Claims | 1-18 |
| | No: | Claims | |

2. Citations and explanations

**see separate sheet**

## Box No. VII Certain defects in the application

**see separate sheet**

## Box No. VIII Certain observations on the application

**see separate sheet**

## Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

D1 WO 2006/081654 A1 (1045929 ONTARIO LTD [CA]; BROUWER GERARDUS J [CA]; MILWAIN ROBERT [CA]) 10 augustus 2006 (2006-08-10)

D2 US 4 162 709 A (WILSON WOODROW L [US]) 31 juli 1979 (1979-07-31)

D3 US 2017/027098 A1 (APOSHIAN STEVEN R [US] ET AL) 2 februari 2017 (2017-02-02)

D4 US 2013/259629 A1 (APOSHIAN STEVEN R [US] ET AL) 3 oktober 2013 (2013-10-03)

D5 US 5 775 436 A (NOYES II THOMAS E [US] ET AL) 7 juli 1998 (1998-07-07)

1 Document D1 is regarded as being the prior art closest to the subject-matter of claim 1, and discloses a sedumplak oogstmachine (10) voor het oogsten van plakken sedumsubstraat van de grond (paragraphs [0089]-[00140]; figures 1-3; please note that document D1 describes a general sod harvester, but as it comprises all the technical features of a sedum sod harvester, document D1 also discloses a 'sedumplak oogstmachine'), omvattende

# een eerste snijeenheid (12-1,12-2,12-3) geconfigureerd voor het snijden van ten minste een langsrand van een strook (14-1,14-2,14-3) sedumsubstraat (figure 3; paragraph [0090]);

# een scheidingskop (20-1,20-2,20-3) geconfigureerd voor het scheiden van de strook (14-1,14-2,14-3) sedumsubstraat van de grond (figure 3; paragraph [0090]);

een eerste transportsysteem (30) voor het ontvangen en transporteren van de door de scheidingskop (20-1,20-2,20-3) van de grond gescheiden strook (14-1,14-2,14-3) sedumsubstraat (figure 4A);

# een tweede snijeenheid (146,146a,584,700/702/704) opgesteld aan het benedenstrooms einde van het eerste transportsysteem (30) en geconfigureerd om een plak (580-1/580-2) sedumsubstraat van de strook (14-1,14-2,14-3) sedumsubstraat te snijden (figures 22, 24, 30, 49 and 53);

een tweede transportsysteem, opgesteld benedenstrooms van de tweede snijeenheid (146), en geconfigureerd om de strook (14-1,14-2,14-3) sedumsubstraat en gesneden plakken sedumsubstraat te ontvangen en te transporteren (figure 4D, note that the second conveyor part of element 34 is posititioned downstream of the second cutting unit 146);

een stapeleenheid geconfigureerd om van het tweede transportsysteem ontvangen gesneden plakken sedumsubstraat te stapelen (paragraph [00132]; figures 19-21).

1.1 The subject-matter of claim 1 therefore differs from this known sedum sod harvester in that

de tweede snijeenheid een snijframe omvat met meerdere aangedreven cirkelvormige snijelementen die dwars op de transportrichting van de strook sedumsubstraat en aangrenzend aan elkaar zijn opgesteld en die zijn geconfigureerd voor beweging in een eerste richting dwars op de transportrichting van het eerste transportsysteem in snijcontact met de strook sedumsubstraat, waardoor een plak sedumsubstraat in de breedterichting van de strook sedumsubstraat wordt gesneden en die is geconfigureerd om in een tweede richting, tegengesteld aan de eerste richting, beweging op een hoogte boven het eerste transportsysteem en het tweede transportsysteem toe te laten zonder aanraking van de strook sedumsubstraat,

and is therefore new.

1.2 The problem to be solved by the present invention may be regarded as how to modify the sedum sod harvester of document D1 to obtain an alternative way of cutting the harvested strips into smaller slabs.

1.3 The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step for the following reasons:

Document D1 proposes different ways to cut harvested strips of sod into smaller slabs, before stacking them. For example, cross cut knife 146 (see figure 4D) cut stripes of harvested sod into two pieces. An alternative knife, element 146a (see figure 30) is also proposed. Additionally, knife 584 is disclosed in different variants (figures 49 and 50A-50E). Lastly, side-by-side mounted knifes 700, 702, 704 are disclosed in figure 53. Based on document D1 alone, the skilled person is provided with many ways to cut harvested strips of sod into smaller slabs, however none of these ways discloses or suggests a solution as provided by the combination of features of claim 1. Moreover, the many examples provided by document D1 lead to skilled person away of thinking about multiple circular cross cutting elements, especially in combination with the additional features 'die zijn geconfigureerd voor beweging in een eerste richting dwars op de transportrichting van het eerste transportsysteem in snijcontact met de strook sedumsubstraat, waardoor een plak sedumsubstraat in de breedterichting van de strook sedumsubstraat wordt gesneden en die zijn geconfigureerd om in een tweede richting, tegengesteld aan de eerste richting, beweging op een hoogte boven het eerste transportsysteem en het tweede transportsysteem toe te laten zonder aanraking van de strook sedumsubstraat'.

Documents D2-D5 disclose other examples of sod harvesters. None of these documents disclose the distinguishing features as listed under above point 1.1. A combination of any of these documents with document D1 will not result in a sedum sod harvester according to claim 1.

Claims 2-18 are dependent on claim 1 and as such also meet the requirements of novelty and inventive step.

## Re Item VII

### Certain defects in the application

2 The relevant background art is not mentioned/identified in the description.

3 Independent claim 1 is not in the two-part form, which in the present case would be appropriate, with those features known in combination from the prior art being placed in the preamble and the remaining features being included in the

characterising part.

## Re Item VIII

### Certain observations on the application

4 Claims 1, 12, 15 and 16 are not clear.

4.1 Claim 1 discloses the two phrase 'die zijn geconfigureerd voor beweging in een eerste richting ...' and 'die is geconfigureerd om in een tweede richting, ...'. The underlined words 'zijn' and 'is' seem to refer to the the circular cutting elements. As there are a plurality of circular cutting elements, it seems that the phrase 'die is geconfigureerd om in een tweede richting, ...' is grammatically incorrect. More importantly, this causes claim 1 to be unclear.

In order not to delay the procedure, a written opinion is provided wherein claim 1 is interpreted/construed as follows:

1. Sedumplak oogstmachine (10) voor het oogsten van plakken (48) sedumsubstraat van de grond (18), omvattende
een eerste snijeenheid (30) geconfigureerd voor het snijden van ten minste een langsrand (24) van een strook (36) sedumsubstraat
een scheidingskop (41) geconfigureerd voor het scheiden van de strook (36) sedumsubstraat van de grond (18);
een eerste transportsysteem (42) voor het ontvangen en transporteren van de door de scheidingskop (41) van de grond (18) gescheiden strook (36) sedumsubstraat;
een tweede snijeenheid (46) opgesteld aan het benedenstrooms einde van het eerste transportsysteem (42) en geconfigureerd om een plak (48) sedumsubstraat van de strook (36) sedumsubstraat te snijden;
een tweede transportsysteem (44), opgesteld benedenstrooms van de tweede snijeenheid (46), en geconfigureerd om de strook (36) sedumsubstraat en gesneden plakken (48) sedumsubstraat te ontvangen en te transporteren;
een stapeleenheid (52) geconfigureerd om van het tweede transportsysteem (44) ontvangen gesneden plakken (48) sedumsubstraat te stapelen;
waarbij de tweede snijeenheid (46) een snijframe (70,72, 73) omvat met meerdere aangedreven cirkelvormige snijelementen (74) die dwars op de

transportrichting van de strook (36) sedumsubstraat en aangrenzend aan elkaar zijn opgesteld en die zijn geconfigureerd voor beweging in een eerste richting dwars op de transportrichting van het eerste transportsysteem (42) in snijcontact met de strook (36) sedumsubstraat, waardoor een plak (48) sedumsubstraat in de breedterichting van de strook (36) sedumsubstraat wordt gesneden en die zijn geconfigureerd om in een tweede richting, tegengesteld aan de eerste richting, beweging op een hoogte boven het eerste transportsysteem (42) en het tweede transportsysteem (44) toe te laten zonder aanraking van de strook sedumsubstraat.

4.2 It seems that claim 12 must be dependent on claim 11 instead of claim 10. Claim 12 is interpreted as such.

4.3 It seems that claim 15 must be dependent on claim 14 instead of claim 13. Claim 15 is interpreted as such.

4.4 It seems that claim 16 must be dependent on claim 15 instead of claim 13. Claim 16 is interpreted as such.