

(19)



Octrooi Centrum
Nederland

(11)

2012073

(12) **C OCTROOI**

(21) Aanvraagnummer: **2012073**

(51)

Int.Cl.:

A01F 15/07 (2006.01)

A01F 15/08 (2006.01)

(22) Aanvraag ingediend: **10.01.2014**

(43) Aanvraag gepubliceerd:

-

(47) Octrooi verleend:
13.07.2015

(45) Octrooischrift uitgegeven:
22.07.2015

(73)

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(54) **Baling device to form bales of loose material having a hybrid baling chamber construction.**

(57) The invention relates to a baling device to form bales of loose material, said bales having a cylindrical shape, comprising:
a frame,
a bale forming device arranged on the frame, wherein the bale forming device comprises multiple bale forming rollers to delimit a baling chamber, and
a feeding device to feed loose material into the baling chamber,
wherein the multiple bale forming rollers comprise multiple movable bale forming rollers that are movably mounted with respect to the frame to adjust a dimension of the baling chamber delimited by the multiple bale forming rollers,
characterized in that, the movable multiple bale forming rollers are at least movable between a first position, in which the bale forming rollers form a substantially cylindrical baling chamber with a first diameter, and a second position, in which the bale forming rollers form a substantially cylindrical baling chamber with a second diameter, wherein the second diameter is at least twice as large as the first diameter.

NL C 2012073

Dit octrooi is verleend ongeacht het bijgevoegde resultaat van het onderzoek naar de stand van de techniek en schriftelijke opinie. Het octrooischrift komt overeen met de oorspronkelijk ingediende stukken.

Baling device to form bales of loose material having a hybrid baling chamber construction.

The present invention relates to a baling device to form bales of loose material. An example of a baling device is an agricultural unit to form bales of crop material, such as hay. The baling device usually comprises a bale forming device configured to form a bale from the loose material in a baling chamber of said bale forming device and a feeding device to feed loose material into the baling chamber. The feeding device may be an intake device to take up loose material, such as crop material, from a ground surface.

In the prior art, bale forming devices having a baling chamber with fixed diameter and bale forming devices having a baling chamber with variable diameter are known.

In a known embodiment of a baling device with baling chamber having a fixed diameter, the baling chamber is formed by multiple bale forming rollers arranged in a circle with a fixed diameter. Generally, a bale forming device having a baling chamber with fixed diameter can be used for the production of bales having a high density of crop material. An example of a bale forming device having a fixed diameter baling chamber can be found in EP1 157 603.

A drawback of a bale forming device having a fixed diameter baling chamber is that the bale forming device can only be used to form bales of a certain fixed diameter.

In a known embodiment of a baling device with baling chamber having a variable diameter, the baling chamber is formed by an endless baler belt tensioned by a number of tensioning rollers. When feeding crop material into the baling chamber formed by the endless baler belt, the diameter of the baling chamber may increase. To make this increase in diameter possible, the endless belt part forming the baling chamber is also increased until a bale with a desired diameter is formed and held by the endless belt. This type of bale forming device makes it possible to use a single construction for producing bales of different diameter. An example of such bale forming device having a baling chamber with variable diameter can be found in EP 1 264 532.

A drawback of a bale forming device having a variable diameter baling chamber formed by an endless belt is that the belt of the baler device is subject to heavy loads and therefore undergo heavy wear.

In the prior art, some baling devices are proposed that use a combination of fixed bale forming rollers and movable bale forming rollers to form baling chambers of different dimension. In all these embodiments, a row of multiple bale forming rollers is mounted on a pivotable arm. The arm is pivotable between different positions to adjust the size of a bale being formed in the baling chamber.

However, in some embodiments, such as for example disclosed in EP 2 570 022 and EP 0 954 958 the range of movement of such arm is limited which results in a very small difference between the maximum diameter and minimum diameter of the baling chamber. In other embodiments, such as for example disclosed in US 4,566,379, there is larger distance between a smaller baling chamber and a larger baling chamber, but the shape of the smaller baling chamber is not substantially cylindrical, which may have a negative influence of the formation of a bale in this smaller size baling chamber.

It is an aim of the invention to provide a baling device lacking one or more of the above drawbacks, or at least to provide an alternative baling device.

The invention provides a baling device to form bales of loose material said bales having a cylindrical shape, comprising:

- a frame,

- a bale forming device arranged on the frame, wherein the bale forming device comprises multiple bale forming rollers to delimit a baling chamber, and

- a feeding device to feed loose material into the baling chamber,

- wherein the multiple bale forming rollers comprise multiple movable bale forming rollers that are movably mounted with respect to the frame to adjust a dimension of the baling chamber delimited by the multiple bale forming rollers,

- characterized in that, the movable multiple bale forming rollers are at least movable between a first position, in which the bale forming rollers form a substantially cylindrical baling chamber with a first diameter, and a second position, in which the bale forming rollers form a substantially cylindrical baling chamber with a second diameter, wherein the second diameter is at least 1.5, preferably at least twice, as large as the first diameter.

By positioning of the movable bale forming rollers in different configurations, the diameter of a baling chamber formed by the bale forming rollers may be adapted to the amount of loose material being present in the baling chamber or to a desired bale diameter.

5 In a first embodiment, the bale forming rollers may be positioned to form a small baling chamber, when relative little loose material is present in the baling chamber. With an increasing quantity of loose material being present in the baling chamber, the position of the bale forming rollers may be adapted to increase the diameter of the baling chamber. The position of the bale forming
10 rollers may continuously or stepwise be adapted to the quantity of loose material in the baling chamber until the bale has obtained the desired bale diameter, and the bale can be ejected from the baling chamber. The desired bale diameter may be the maximum diameter that can be formed by the bale forming rollers, or a smaller size.

15 In a second embodiment, the bale forming rollers may be positioned in a configuration forming a baling chamber with the desired diameter selected from a number or range of different baling chamber diameters that can be created by the movable bale forming rollers. Loose material may be fed into the formed baling chamber until sufficient loose material has been fed into the baling chamber
20 to form the bale with the desired diameter in correspondence with the positions of the bale forming rollers.

 The advantage of the bale forming rollers forming the baling chamber with variable diameter is that the bale forming rollers ensure high quality bales having high density and which can be obtained with relative high speed,
25 while at the same time bales of any desired diameter can be produced by the bale forming device.

 The movement of the bale forming rollers between different positions may be created in any suitable way. The position of the bale forming rollers may be actively, for instance by direct actuators, or passively, for instance by
30 tensioning, controlled.

 In an embodiment, the movable bale forming rollers are individually movable or movable in pairs with respect to the frame. This means that the position of the bale forming rollers can be individually or in pairs be adapted to form a substantially cylindrical baling chamber of suitable size. Individually

movable means that the rotation axes of the movable bale forming rollers are not fixed with respect to each other, but that the rotation axes are movable with respect to each other. However, flexible means may be provided between individually movable bale forming rollers, for example to maintain a predetermined distance between rotation axes of adjacent bale forming rollers.

Correspondingly, pairs of bale forming rollers comprising two bale forming rollers at a fixed position with respect to each other, may be movable with respect to other bale forming rollers and are not fixed with respect to these other bale forming rollers. However, flexible means may be provided between the pair of movable bale forming rollers, for example to maintain a predetermined distance between rotation axes of the pair of bale forming rollers and other movable bale forming rollers.

In an embodiment, two or more movable bale forming rollers are connected to each other by flexible means that allow the two or more bale forming rollers to adapt their position to a part of a circumference of a circle in order to form a substantially cylindrical baling chamber. By connecting two or more movable bale forming rollers to each other by flexible means, the flexible means may allow the two or more bale forming rollers to adapt their position to a part of a circumference of a circle in order to form a substantially cylindrical baling chamber. At the same time, between two adjacent bale forming rollers may be substantially held at a desired mutual distance to avoid that loose material may leave the baling chamber between two mutual bale forming rollers.

The flexible means may for example comprise bands, chains, or other elongate elements that can be tensioned to pull the movable bale forming rollers around the loose material in a substantially cylindrical configuration.

In an embodiment, the flexible means can be placed actively or passively under tension to pull the movable bale forming rollers against a bale being formed in the baling chamber.

In an embodiment, substantially all of the multiple bale forming rollers that delimit the baling chamber are movably mounted to the frame. Substantially all of the multiple bale forming rollers means at least 80 % of the bale forming rollers that can form a baling chamber with maximum diameter, are movably mounted on the frame. In a further embodiment, all bale forming rollers except two

bale forming rollers at opposite sides of an outlet of the feeding device are mounted movably on the frame.

In an embodiment, the movable bale forming rollers chamber are each movable in a direction substantially radially to the central axis of the baling chamber formed by the bale forming rollers. It is an aspect of the invention that the bale forming rollers by movement of the movable bale forming rollers form substantially cylindrical baling chambers at different diameters. A movement of the bale forming rollers in a direction substantially radially to the central axis of the baling chamber, at that position, formed by the bale forming rollers is very suitable to move the movable bale forming rollers to the different positions to form substantially cylindrical baling chambers with different diameters.

In an embodiment, the movable bale forming rollers are movable between an inner position in which no baling chamber or a baling chamber with a first volume is formed by the multiple bale forming rollers, and an outer position in which a baling chamber with a second volume is formed by the multiple bale forming rollers, wherein the second volume is larger than the first volume.

In the outer position of the movable bale forming rollers, the bale forming rollers may for instance form a baling chamber having a relative large diameter. In the inner position a number of the bale forming rollers may be arranged close to each other so that no baling chamber is formed between these bale forming rollers, while other bale forming rollers are used in the inner position to form a relative small baling chamber. Preferably, the relative small baling chamber is formed by the bale forming rollers close to the outlet of the feeding device, so that the bale is formed close to the outlet, preferably adjacent to the outlet of the feeding device.

In an embodiment, the movable multiple bale forming rollers are biased to the inner position. By biasing the bale forming rollers to the inner position, the bale forming rollers will have the tendency to form a relatively small baling chamber in which loose material can be introduced. When during formation of a bale in the baling chamber, the forces exerted by the growing bale exceed the biasing forces with which the bale forming rollers are biased towards the inner position, the bale forming rollers may be pushed outwards by the growing bale to form a baling chamber having a larger diameter. In this way a balance can be maintained between the biasing forces with which the bale forming rollers are

biased towards the inner position and the outward forces exerted by the growing bale. As a result, the biasing force of the bale forming rollers can be used to set and/or adjust the tensioning of the bale and therewith the crop density in the bale.

It is remarked that the bale forming rollers may directly or indirectly
5 be biased to the inner position.

In the inner position, little space may be present between the adjacent bale forming rollers of the two arrays. Therefore, in the inner position, the bale forming rollers may be arranged close to each other, for instance parallel to each other at a relative close distance. With an increasing bale size within the
10 baling chamber the bale forming rollers of the two opposed arrays of bale forming rollers may move away from each other to form a baling space of increasing diameter there between.

In an embodiment, the movable bale forming rollers are arranged in two arrays, wherein the baling chamber is formed between the two arrays of bale
15 forming rollers, preferably two rows of bale forming rollers.

In an embodiment, the movable bale forming rollers of each array are connected to each other by flexible means, that allow each array of bale forming rollers to adapt its shape to a part of a circumference of a circle in order to form a substantially cylindrical baling chamber. In a further embodiment, the flexible
20 means can be placed actively or passively under tension to pull the movable bale forming rollers against a bale being formed in the baling chamber.

In an embodiment, the first row of movable bale forming rollers is mounted on the frame, and the second row of movable bale forming rollers is mounted on a tiltable tailgate of the baling device. By opening the tailgate, the two
25 arrays of bale forming rollers can be moved away from each other and a bale can be released from the baling chamber.

The movable bale forming rollers should be moved from the inner position to an outer position in such a way that during this movement a substantially cylindrical baling chamber is formed by the bale forming rollers.
30 When the bale forming rollers are arranged in two adjacent arrays in the inner position, the bale forming rollers cannot be simultaneously moved away from each other at the same speed and moment since the resulting space between the rollers will not have a cylindrical shape.

Instead it will generally be desirable that the rollers relative close to the outlet of the feeding device will form a baling chamber having a cylindrical shape with a small diameter, and when required these rollers will move away from each other to create more space between the bale forming rollers. The gap which may
5 then come into existence at the side of the baling space remote from the outlet of the feeding device may be filled by bale forming rollers which did not yet take part in forming a baling chamber, to remain a baling chamber having a substantially cylindrical shape.

In an embodiment, the bale forming device comprises a roller
10 displacement mechanism, configured to actively or passively move the movable bale forming rollers to maintain a substantially cylindrical baling space of variable size. To ensure that the bale forming rollers will form a baling substantially cylindrical chamber, a roller displacement mechanism may be provided that actively or passively moves the bale forming rollers to form a baling chamber with
15 a substantially cylindrical shape.

In an embodiment, the roller displacement mechanism comprises a tensioning slide configured to hold together pairs of movable bale forming rollers, formed by two opposed bale forming rollers from the two arrays, and wherein the tensioning slide is configured to release the pairs of movable bale forming rollers
20 with an increasing bale diameter of a bale formed or being formed in the baling chamber to make increase of the diameter of the substantially cylindrical baling chamber possible. The tensioning slide may, with an increasing diameter of the baling chamber release pairs of bale forming rollers, such that the pair of bale forming rollers may be spaced from each other and form part of the multiple bale
25 forming rollers forming the baling chamber.

The tensioning slide may be biased to hold all or at least a relative large number of pairs of movable bale forming rollers together. The outwards force exerted by the growing bale in the baling chamber the tensioning slide may be forced to release pairs of bale forming rollers to make the provision of a larger
30 baling space possible.

In an embodiment, the tensioning slide is configured to release the pairs of movable bale forming rollers starting from an outlet of the feeding device. The released pairs of bale forming rollers may be tensioned around the bale formed or being formed in the baling chamber. To ensure that a substantially

cylindrical baling chamber is formed adjacent to the outlet of the feeding device, the tensioning slide is configured to release the pairs of bale forming rollers starting from the side of an outlet of the feeding device.

5 In an embodiment, the released pairs of movable bale forming rollers are pulled around the bale formed or being formed in the baling chamber to form a cylindrical baling chamber. By exerting a pulling force on the bale forming rollers, the bale forming rollers will due to the presence of loose material in the baling chamber assume a substantially cylindrical shape.

10 In an embodiment the tensioning force exerted by the roller displacement mechanism, for example the tensioning slide, may be adjustable and/or may be change in dependence of the diameter of the substantially cylindrical baling space formed by the bale forming rollers. It may for example be desirable that the tensioning force exerted by the tensioning slide is relatively small when a baling chamber with a relatively small diameter is formed by the bale
15 forming rollers, and that the tensioning force increases with increasing diameter of the baling chamber formed by the bale forming rollers. Also, it may be desirable to substantially increase the tensioning force when the bale formed in the baling chamber has the desired diameter, in particular when this diameter is smaller than the maximum diameter. In such case it may be advantageous that the tensioning
20 force may be adjusted and/or may be different at different diameters of the baling chamber formed by the bale forming rollers, so that the density of the loose material of the bale can be increased before release of the bale from the bale forming device.

25 In an embodiment, the roller displacement mechanism may comprise guiding means such as guide rails, guide channel, or guide grooves, to guide the movable bale forming rollers in a movement between the inner position and the outer position. By the provision of guide means, such as guide rails, guide channels, or guide grooves, the positions of the bale forming rollers may be controlled more accurately.

30 In an embodiment, the bale forming device is a bale forming device without an endless baler belt for forming a bale. The bale forming device according to the invention may be configured without an endless bale forming belt, since the movable bale forming rollers are configured to form a baling chamber.

In an embodiment, adjacent movable bale forming rollers of the movable bale forming rollers are arranged closely adjacent to each other to prevent or minimize that loose material leaves the baling chamber through a space formed between the neighboring rollers.

5 In an embodiment, the movable bale forming rollers are arranged in two arrays, wherein a first row of bale forming rollers is mounted on the frame, and the second row of bale forming rollers is mounted on a tiltable tailgate of the baling device.

In an embodiment, the bale forming device comprises one or more
10 actuators to actively control a position of one or more movable bale forming rollers. Instead of tensioning the bale forming rollers on the bale being formed in the baling chamber formed by the bale forming rollers the position of the bale forming rollers may also be actively controlled by a number of actuators. For example, the bale forming rollers may be positioned to form a cylindrical baling space with a
15 desired diameter, so that loose material can be introduced into the baling chamber until a bale with the desired diameter has been produced. In such embodiment each bale forming roller may have its own actuator or actuators, but also two or more bale forming rollers may together be actuated by one or more actuators.

In an embodiment, the bale forming device comprises a control
20 system comprising one or more sensors to measure an actual diameter of a bale in the baling chamber and/or pressure exerted on one or more of the bale forming rollers, and a controller to control the one or more actuators on the basis of the measured actual diameter and/or the measured pressure.

An embodiment of a baling device according to the invention will now
25 be described in further detail, by way of example only, with reference to the accompanying drawings, in which:

Figures 1-3 show side views of the baling device according to the invention;

Figures 1-3 show cross sections of an embodiment of an agricultural baling device, generally indicated with reference numeral 1. The baling device 1
30 comprises a frame 2 which is supported by wheels 3. The baling device 1 is configured to be connected at its front end 4 to a pulling vehicle, for instance a tractor.

The baling device 1 comprises an intake device 5 to take in crop material, such as silage, grass, hay, from a ground surface. The intake device 5

comprises an inlet 6 and an outlet 7. At opposite sides of the outlet 7 supporting rollers 8 are provided.

Via the inlet 6 crop material may be taken from the ground surface and transported to the outlet 7. A roll provided at the inlet 6 may be provided with
5 tines to facilitate the picking up of crop material.

A bale forming device 9 is arranged on the frame 2 to form bales of crop material.

The bale forming device 9 comprises a first set of bale forming rollers 10 and a second set of bale forming rollers 11. The bale forming rollers 10, 11 are
10 configured to form a baling chamber 12 in which a bale B of crop material can be formed which crop material is introduced into the baling chamber 12 from the outlet 7 of the intake device 5. Neighboring bale forming rollers 10, 11 of the bale forming rollers of the first set and the second set, respectively, are arranged closely adjacent to each other to prevent or minimize that crop material leaves the
15 baling chamber 12 through a gap formed between the neighboring bale forming rollers of the first set or the second set.

The bale forming rollers 10 and bale forming rollers 11 are movable between an inner position, shown in solid lines in Figure 1 and an outer position, shown in dashed lines in Figure 1. The movements between the inner position and
20 the outer position are for each bale forming roller 10, 11 schematically indicated by double headed arrows. By movement of the bale forming rollers 10 and the bale forming rollers 11 substantially cylindrical baling chambers with different diameters can be configured.

In the inner position of the bale forming rollers 10, 11 a relatively
25 small baling chamber is formed adjacent to the outlet 7 of the intake device 5. Only a limited number of the bale forming rollers 10, 11 actually form the relative small baling chamber 12. The further bale forming rollers 10, 11 are arranged in two parallel rows between which there is little space so that no or very little crop material will be collected between these two parallel rows. In the outer position, as
30 also shown in Figure 3, the bale forming rollers 10 and the bale forming rollers 11 are moved further away from each other to form a substantially cylindrical baling chamber 12 with a relative large diameter. In this outer position, in which a baling chamber 12 with relatively large volume is formed by the multiple bale forming

rollers 10, 11, all bale forming rollers 10, 11 are used to form the baling chamber 12.

Figure 2 shows an intermediate position of the bale forming rollers 10, 11 between the inner position and the outer position. In this intermediate position a substantially cylindrical baling chamber 12 is formed having a diameter between the relatively small baling chamber 12 formed with the bale forming rollers 10, 11 in the inner position and the relatively large baling chamber formed with the bale forming rollers 10, 11 in the outer position.

The first set of bale forming rollers 10 is arranged in a first row and mounted on the frame 2. The second set of bale forming rollers 10 is arranged in a second row and mounted on a tailgate 13. The tailgate 13 is pivotably mounted at a pivot axis 14 on the frame 2 to be movable between a closed position, as shown in Figure 1, and an open position in which a bale may be released from the baling device 1.

The baling device comprises a roller displacement mechanism 15, configured to control the movements of the bale forming rollers 10, 11 between the inner position and the outer position. The roller displacement mechanism 15 is configured to bias the bale forming rollers to the inner position. Biasing force is obtained by a tensioning slide 16 that pulls the bale forming rollers of the first set of bale forming rollers 10 and the second set of bale forming rollers 11 towards each other.

The tensioning slide 16 is configured to pull pairs formed by a bale forming roller 10 of the first set and an opposed bale forming roller 11 of the second set towards each other, whereby with increasing tension on the bale forming rollers 10, 11 the pairs are subsequently released to make an increase in the size of the baling chamber 12 formed by the bale forming rollers 10, 11 possible.

The tensioning slide 16 comprises at each side of the baling device 1 two pulling lines 17, 18, for instance chains (only one side shown). The first pulling line 17 connects all bale forming rollers 10 of the first set of bale forming rollers 10 with each other, and the second pulling line 18 connects all bale forming rollers of the second set of bale forming rollers 11 with each other. A slide block 19 is provided to hold together the first pulling line 17 and the second pulling line 18 at a

distance substantially corresponding with the distance between a pair of adjacent bale forming rollers 10 and 11 of the first and second set in their inner positions.

The slide block 19 is movable in a direction parallel to the first and second rows formed by the bale forming rollers 10, 11 in their inner positions, as
5 can be seen by the comparison of Figures 1, 2 and 3. The slide block 19 is biased by biasing means towards the outlet 7 so that when no force is exerted on the bale forming rollers 10, 11, the slide block 19 will be moved towards the outlet 7 of the intake device, and therewith the bale forming rollers 10, 11 are biased to the inner positions.

10 The parts of the pulling lines 17, 18 between the slide block 19 and the outlet 7 of the intake device are used to form a baling chamber 12. The bale forming rollers 10, 11 of these parts of the pulling lines 17, 18 will be pulled tight around a bale being formed in the baling chamber and assume a substantially circular arrangement resulting in a substantially cylindrical baling space being
15 formed by these bale forming rollers 10, 11.

By movement of the slide block 19 in a direction away from the outlet 7, pairs of bale forming rollers 10, 11 can be released from the slide block 19 so that these pairs of bale forming rollers 10, 11 can cooperate with the other bale forming rollers 10, 11 between the slide block 19 and the outlet 7 to form a baling
20 chamber. A larger number of bale forming rollers 10, 11 available to form a baling space results in a larger baling space being formed.

Thus, in Figure 1, the tensioning slide 16 holds together a relative large number of pairs of bale forming rollers 10, 11 so that the relatively small baling chamber 12 is formed. Due to crop material introduced into the baling
25 chamber 12 by the intake device 5, a bale B will come into existence and grow in the baling chamber 12. When the bale B continues to grow the bale forming rollers 11 will press against the bale, which improves the density of the bale and thus the bale quality.

As a reaction force the bale will exert an outwards force on the bale
30 forming rollers 10, 11 that form the baling chamber 12. When the outwards force exceeds the tensioning force of the tensioning slide 16, i.e. the biasing force with which the slide block 19 is biased towards the outlet 7, the tensioning slide 16 will release a further pair of opposed bale forming rollers 10, 11 of the first set and the second set. Due to the tensioning force exerted by the tensioning slide 16 the bale

forming rollers 10, 11 are pulled around the bale to form the substantially cylindrical baling space 12 which will increase in diameter due to the release of the bale forming rollers 10, 11. By further growth of the bale B within the baling chamber 12 and release of further pairs of bale forming rollers 10, 11, the baling chamber size will further adjust to the diameter of the bale B until the desired bale diameter has been obtained. This desired bale diameter may be the maximum diameter that can be formed by the bale forming rollers 10, 11 such as shown in Figure 3, or a smaller diameter.

In the shown embodiment, the movement of the bale forming rollers between the inner position and the outer position is controlled by the tension force obtained by the tension slide 16 in reaction on the outward force exerted on the bale forming rollers 10, 11 of a bale B being formed in the baling chamber 12 formed by the bale forming rollers 10, 11. The bale forming rollers 10, 11 are pulled around the bale and assume a substantially circular arrangement.

The slide block 19 is biased towards outlet 7 of the intake device 5 to obtain a tensioning force to pull the bale forming rollers around the bale B being formed in the baling space. In an alternative embodiment, the position of the slide block 19 may be actively controlled by an actuator, for example a hydraulic linear actuator. In such embodiment, it may be advantageous to use a sensor to measure a relevant parameter to control the position of the block 19. This relevant parameter may for instance comprise the bale diameter of the bale being formed in the baling chamber or the tensioning force in the pulling lines 17, 18.

In further alternative embodiments, one or more bale forming rollers may be connected to an actuator to, directly or indirectly, control the position of the respective one or more bale forming rollers. A controller may be configured to position the one or more bale forming rollers in the desired position. The desired position may be determined on the basis of an actual diameter of a bale being formed in the baling chamber and/or a radially outwards force exerted on the bale forming rollers.

Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims.

	1	baling device
	2	frame
	3	wheels
	4	front end
5	5	intake device
	6	inlet
	7	outlet
	8	supporting rollers
	9	bale forming device
10	10	first set of bale forming rollers
	11	second set of bale forming rollers
	12	baling chamber
	13	tailgate
	14	pivot axis
15	15	roller displacement mechanism
	16	tensioning slide
	17	first pulling line
	18	second pulling line
	19	slide block
20	B	bale

CONCLUSIES

1. Een baalvormende inrichting (1) voor het vormen van balen (B) van los materiaal, welke balen een cilindrische vorm hebben, omvattende:

- 5 - een gestel (2),
- een baalvormende inrichting (9) verschaft op het frame (2), waarbij de baalvormende inrichting meerdere baalvormende rollen (10, 11) omvat om een baalkamer (12) af te bakenen, en
- 10 - een toevoerinrichting (5) voor het toevoeren van los materiaal aan de baalkamer, waarbij de meerdere baalvormende rollen meerdere verplaatsbare baalvormende rollen omvat die verplaatsbaar ten opzichte van het gestel zijn aangebracht teneinde een door de meerdere baalvormende rollen afgebakende afmeting van de baalkamer aan te passen,

15 **met het kenmerk ,dat** de meerdere verplaatsbare baalvormende rollen (10, 11) ten minste verplaatsbaar zijn tussen een eerste positie, waarin de baalvormende rollen een in hoofdzaak cilindrische baalkamer (12) met een eerste diameter vormen, en een tweede positie, waarin de baalvormende rollen een in hoofdzaak cilindrische baalkamer (12) met een tweede diameter vormen, waarbij de tweede diameter ten minste 1.5 maal zo groot is als de eerste diameter.

20 2. De baalvormende inrichting (1) volgens conclusie 1, waarbij de verplaatsbare baalvormende rollen individueel of in paren verplaatsbaar zijn ten opzichte van het gestel.

3. De baalvormende inrichting (1) volgens conclusie 1 of 2, waarbij twee of meer verplaatsbare baalvormende rollen (10,11) door middel van flexibele middelen (17, 18) met elkaar verbonden zijn die het mogelijk maken dat de twee of meer baalvormende rollen hun positie aanpassen aan een deel van een omtrek van een cirkel teneinde een in hoofdzaak cilindrische baalkamer (12) te vormen.

4. De baalvormende inrichting (1) volgens één van de conclusies 1-3, waarbij in hoofdzaak alle van de meerdere baalvormende rollen (10, 11) die de baalkamer afbakenen verplaatsbaar zijn op het gestel zijn aangebracht.

5. De baalvormende inrichting (1) volgens één van de conclusies 1-4, waarbij de verplaatsbare baalvormende rollen (10, 11) elk in een richting

verplaatsbaar zijn die in hoofdzaak radiaal is ten opzichte van de centrale as van de door de baalvormende rollen gevormde baalkamer (12).

6. De baalvormende inrichting (1) volgens één van de conclusies 1-5, waarbij de verplaatsbare baalvormende rollen (10, 11) verplaatsbaar zijn naar een binnenste positie waarin geen baalkamer of een baalkamer met een eerste volume is gevormd door de meerdere baalvormende rollen, en een buitenste positie waarin een baalkamer met een tweede volume is gevormd door de meerdere baalvormende rollen, waarbij het tweede volume groter is dan het eerste volume, en waarbij de verplaatsbare baalvormende rollen bij voorkeur de eerste positie innemen.

7. De baalvormende inrichting (1) volgens één van de conclusies 1-6, waarbij de baalvormende rollen opgesteld zijn in een twee rasters.

8. De baalvormende inrichting (1) volgens conclusie 7, waarbij de verplaatsbare baalvormende rollen (10, 11) van elk raster met elkaar verbonden zijn door middel van flexibele middelen (17, 18) zodat elk raster van baalvormende rollen zijn vorm kan aanpassen aan een deel van de omtrek van een cirkel teneinde een in hoofdzaak cilindrische baalkamer te vormen.

9. De baalvormende inrichting (1) volgens conclusies 7 of 8, waarbij de beide rasters in hoofdzaak parallel zijn opgesteld wanneer de verplaatsbare baalvormende rollen (10, 11) in de binnenste positie zijn geplaatst.

10. De baalvormende inrichting (1) volgens één van de conclusies 1-9, waarbij de baalvormende inrichting een rollenverplaatsingsmechanisme (15) omvat dat is ingericht om actief of passief de verplaatsbare baalvormende rollen (10, 11) te verplaatsen teneinde een in hoofdzaak cilindrische baalruimte van een variabele afmeting te handhaven.

11. De baalvormende inrichting (1) volgens conclusies 10, waarbij het rollenverplaatsingsmechanisme (15) is ingericht om de baalkamer (12) naast een uitlaat van de toevoerinrichting (5) te vormen.

12. De baalvormende inrichting (1) volgens conclusies 10 of 11, waarbij het rollenverplaatsingsmechanisme (15) een spanslede (16) omvat ingericht om paren van verplaatsbare baalvormende rollen (10, 11) samen te houden, die worden gevormd door twee tegenover elkaar gelegen baalvormende rollen van de twee

rasters, en waarbij de spanslede is ingericht om de twee paren van baalvormende rollen vrij te laten bij een toenemende baaldiameter van een gevormde baal of van een baal die wordt gevormd in de baalkamer (12) teneinde een toename van de diameter van de hoofdzakelijk cilindrische baalkamer mogelijk te maken.

5 13. De baalvormende inrichting (1) volgens conclusie 12, waarbij de spanslede (16) is ingericht om, startend vanaf de kant van een uitlaat van de toevoerinrichting, de twee paren van baalvormende rollen vrij te laten.

14. De baalvormende inrichting (1) volgens conclusie 12 of 13, waarbij de vrijgelaten paren van verplaatsbare baalvormende rollen gespannen zijn rondom de
10 gevormde baal of de te vormen baal in de baalkamer (12) teneinde een cilindrische baalkamer te vormen.

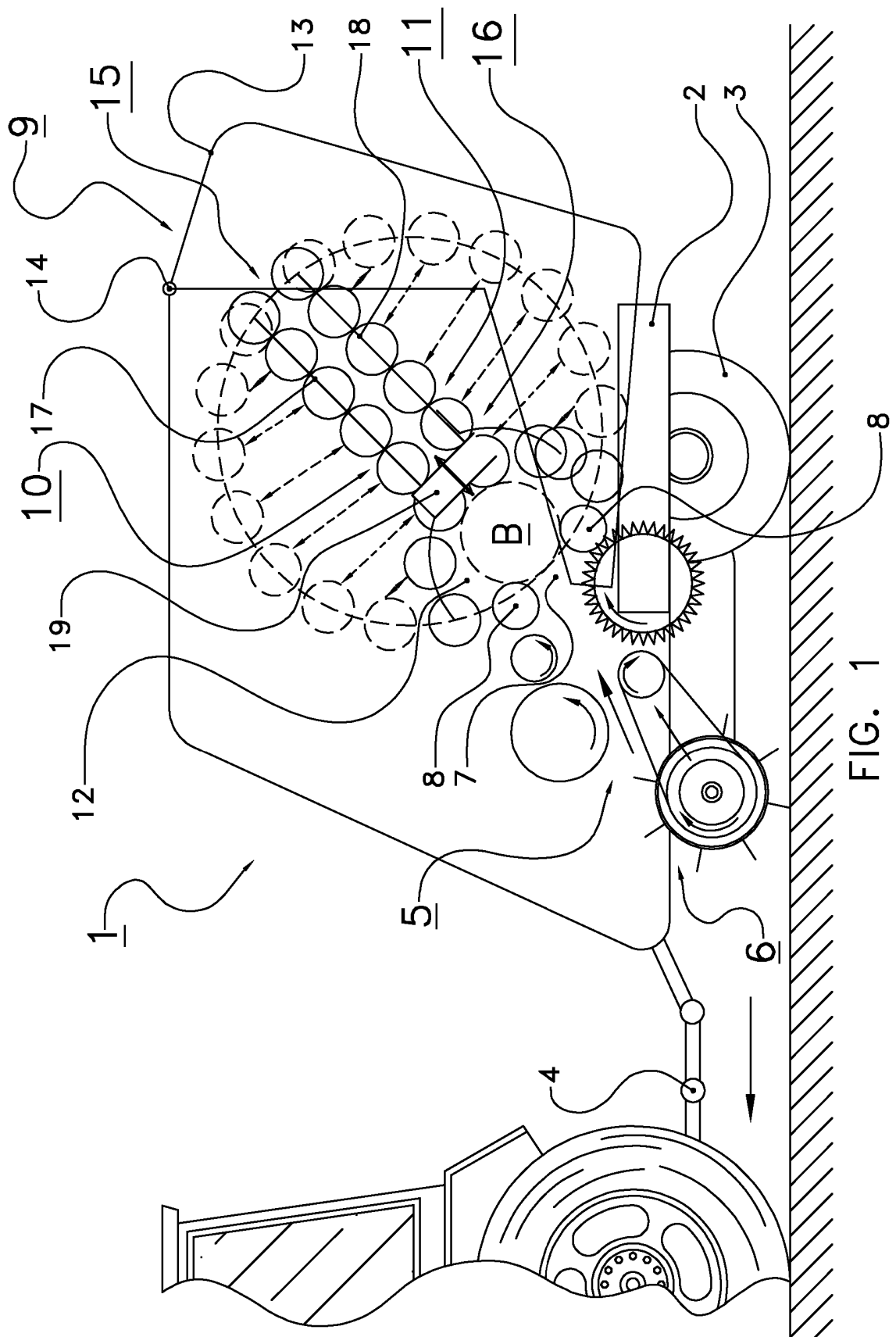
15. De baalvormende inrichting (1) volgens één van de conclusies 1-14, waarbij de baalvormende inrichting (9) geen eindloze baalriem omvat voor het vormen van een baal.

15 16. De baalvormende inrichting (1) volgens één van de conclusies 1-15, waarbij naburige rollen van de verplaatsbare baalvormende rollen (10, 11) in elkaars nabijheid zijn aangebracht teneinde te voorkomen of te minimaliseren dat los materiaal de baalkamer (12) verlaat door een ruimte gevormd tussen twee naburige rollen.

20 17. De baalvormende inrichting (1) volgens één van de conclusies 1-16, waarbij de verplaatsbare baalvormende rollen (10, 11) in twee rasters zijn geplaatst, waarbij een eerste rij van baalvormende rollen is aangebracht op het gestel (2), en de tweede rij van baalvormende rollen is aangebracht op een zwenkbare deur (13) van de baalvormende inrichting.

25 18. De baalvormende inrichting (1) volgens één van de conclusies 1-17, waarbij de baalvormende inrichting (9) één of meer actuatoren omvat om actief een positie van één of meer verplaatsbare baalvormende rollen (10, 11) te besturen.

19. De baalvormende inrichting (1) volgens één van de conclusies 1-18, waarbij de baalvormende inrichting (9) een besturingssysteem omvat voorzien van
30 één of meer sensoren om een actuele diameter te meten van een baal in een baalkamer (12), en een regelaar omvat om de ene of meerdere actuatoren te besturen op basis van de gemeten actuele diameter van de baal.



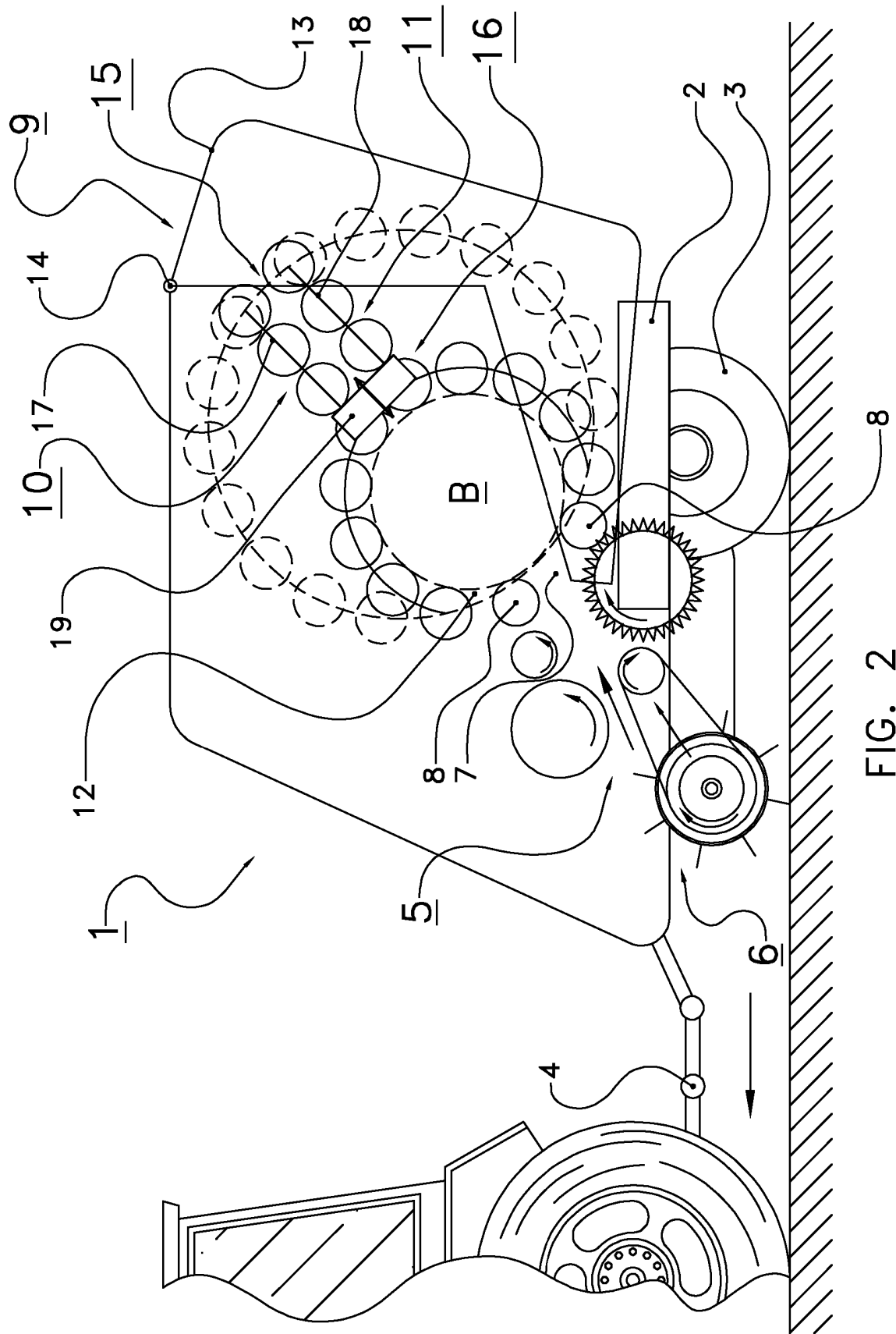
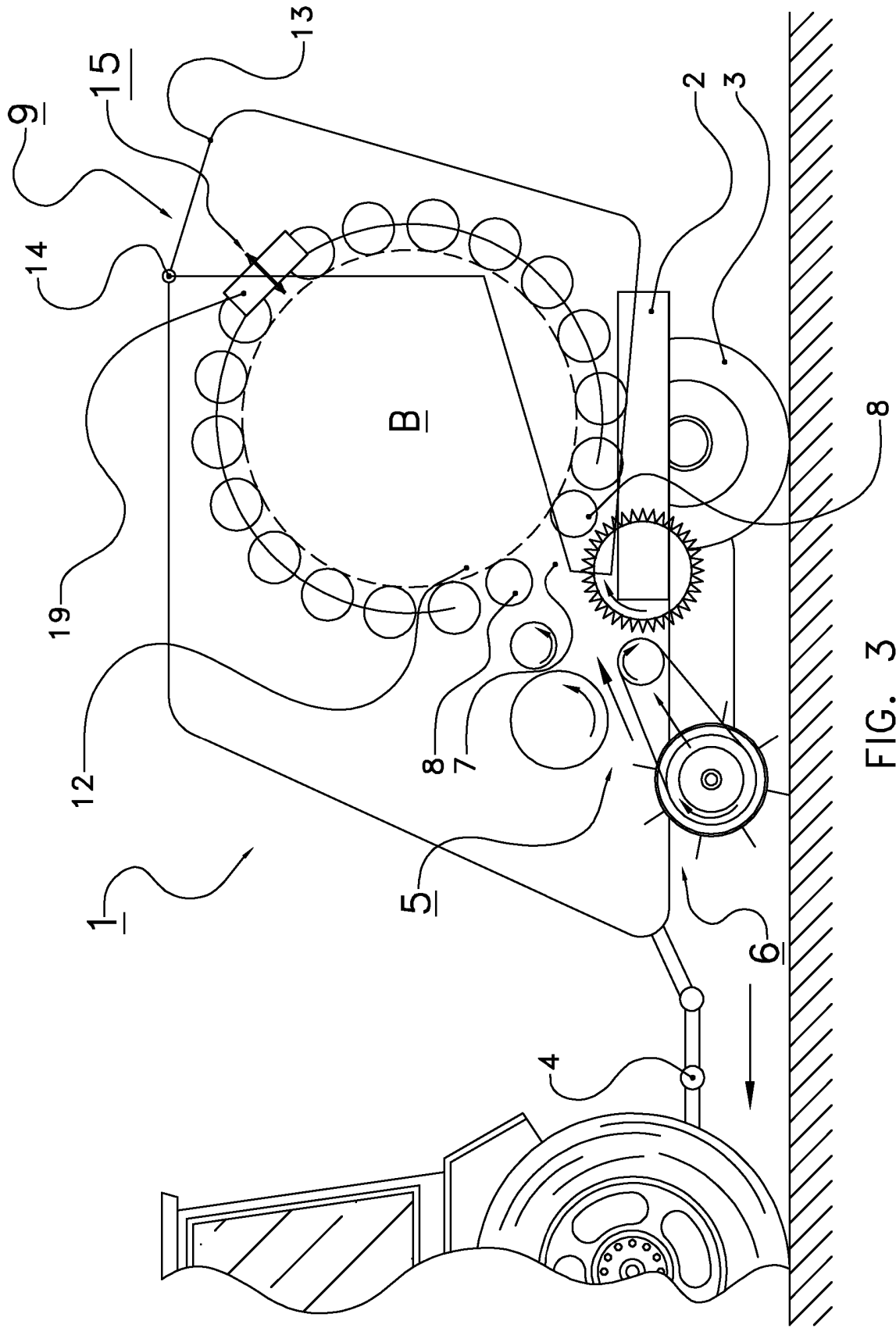


FIG. 2



SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE		KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE	
		D4727/NLP	
Nederlands aanvraag nr.		Indieningsdatum	
2012073		10-01-2014	
		Ingeroepen voorrangsdatum	
Aanvrager (Naam)			
Forage Innovations B.V.			
Datum van het verzoek voor een onderzoek van internationaal type		Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.	
19-04-2014		SN 61828	
I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)			
Volgens de internationale classificatie (IPC)			
A01F15/07		A01F15/08	
II. ONDERZOCHETE GEBIEDEN VAN DE TECHNIEK			
Onderzochte minimumdocumentatie			
Classificatiesysteem		Classificatiesymbolen	
IPC		A01F	
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 2012073

A. CLASSIFICATIE VAN HET ONDERWERP

INV. A01F15/07 A01F15/08
ADD.

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

B. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
A01F

Onderzochte andere documentatie dan de minimum 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.
X	US 4 765 237 A (VANSTEELANT MARC G [BE] ET AL) 23 augustus 1988 (1988-08-23) * kolom 3, regel 27 - regel 44 * * kolom 4, regel 23 - regel 67 * * kolom 5, regel 4 - regel 20 * * kolom 6, regel 11 - regel 27 * * kolom 7, regel 34 - kolom 8, regel 8 * * kolom 9, regel 34 - regel 50 * * kolom 10, regel 27 - regel 61 * * figuren 1-4 * ----- -/--	1-3,5-7, 10,11, 15,16,18

☒ Verdere documenten worden vermeld in het vervolg van vak C.

☒ 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 octrooiaanvraag vermeld

"E" eerdere octrooi(aanvraag), 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 octrooiaanvraag, 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

7 oktober 2014

Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type

Naam en adres van de instantie

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
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De bevoegde ambtenaar

Baltanás y Jorge, R

**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 2012073

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN		
Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	US 4 288 971 A (MCCLURE JOHN R) 15 september 1981 (1981-09-15)	1,2,5,6, 10,11, 15,16
A	* kolom 2, regel 67 - kolom 3, regel 30 * * kolom 4, regel 43 - regel 55 * * kolom 5, regel 8 - regel 22 * * figuren 1, 5 *	4,17,18
X	----- US 6 170 245 B1 (UNDERHILL KENNETH R [US]) 9 januari 2001 (2001-01-09) * kolom 4, regel 11 - regel 21 * * kolom 4, regel 63 - kolom 5, regel 37 * * figuren 1-3 *	1,2,5,6, 10,11,16
X	----- US 2010/326294 A1 (SMITH KEVIN M [US] ET AL) 30 december 2010 (2010-12-30) * alinea [0023] - alinea [0024] * * figuren 1, 2 *	1,2,5,6, 10,11, 16,18,19
A	----- US 6 101 933 A (ESKEN DIRK [DE]) 15 augustus 2000 (2000-08-15) * kolom 1, regel 61 - kolom 2, regel 11 * * figuren 1, 2 *	1-3,6,15

**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 2012073

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 4765237	A	23-08-1988	DE 3668749 D1 15-03-1990 EP 0264492 A1 27-04-1988 US 4765237 A 23-08-1988
US 4288971	A	15-09-1981	CA 1152376 A1 23-08-1983 DE 3163726 D1 28-06-1984 EP 0037155 A1 07-10-1981 US 4288971 A 15-09-1981
US 6170245	B1	09-01-2001	DE 69905511 D1 03-04-2003 DE 69905511 T2 04-09-2003 DE 69910485 D1 25-09-2003 DE 69910485 T2 26-02-2004 EP 0954959 A1 10-11-1999 EP 0954960 A1 10-11-1999 EP 0954961 A1 10-11-1999 US 6094900 A 01-08-2000 US 6098391 A 08-08-2000 US 6170245 B1 09-01-2001
US 2010326294	A1	30-12-2010	EP 2269440 A1 05-01-2011 US 2010326294 A1 30-12-2010
US 6101933	A	15-08-2000	DE 29814775 U1 12-11-1998 FR 2782442 A1 25-02-2000 PL 334483 A1 28-02-2000 US 6101933 A 15-08-2000

WRITTEN OPINION

File No. SN61828	Filing date (day/month/year) 10.01.2014	Priority date (day/month/year)	Application No. NL2012073
International Patent Classification (IPC) INV. A01F15/07 A01F15/08			
Applicant Forage Innovations 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 Baltanás y Jorge, R
--	---------------------------------

WRITTEN OPINION

Application number
NL2012073

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 and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing:
 - ☐ contained in the application as filed.
 - ☐ filed together with the application in electronic form.
 - ☐ furnished subsequently for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
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	4, 8, 9, 12-14, 17, 19
	No: Claims	1-3, 5-7, 10, 11, 15, 16, 18
Inventive step	Yes: Claims	4, 8, 9, 12-14, 17
	No: Claims	1-3, 5-7, 10, 11, 15, 16, 18, 19
Industrial applicability	Yes: Claims	1-19
	No: Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Application number
NL2012073

Box No. VII Certain defects in the application

see separate sheet

Box No. VIII Certain observations on the application

see separate sheet

Item V

Reference is made to the following documents:

- D1 US 4 765 237 A (VANSTEELANT MARC G [BE] ET AL) 23 augustus 1988 (1988-08-23)
- D2 US 4 288 971 A (MCCLURE JOHN R) 15 september 1981 (1981-09-15)
- D3 US 6 170 245 B1 (UNDERHILL KENNETH R [US]) 9 januari 2001 (2001-01-09)
- D4 US 2010/326294 A1 (SMITH KEVIN M [US] ET AL) 30 december 2010 (2010-12-30)
- D5 US 6 101 933 A (ESKEN DIRK [DE]) 15 augustus 2000 (2000-08-15)

- 1 Document D1 discloses a baler comprising a frame (5), a bale forming device on the frame (5) comprising a plurality of rollers (8, 11, 12) delimiting a baling chamber, a feeding device (1) for feeding material into the baling chamber, wherein the plurality of rollers (8, 11, 12) comprises a plurality of movable rollers (11, 12) which can be displaced with regard to the frame (5) in order to adapt the size of the baling chamber, and wherein the plurality of movable rollers (11, 12) can be displaced at least between a first position (figures 1 or 4, full lines) in which a first substantially cylindrical (see figures 1 and 4, and also column 4, lines 23 to 26, column 9, lines 39 to 43, and also column 10, lines 59 to 62) baling chamber with a first diameter is formed, and a second position (see figures 1 and 4, dotted lines) in which a second substantially cylindrical baling chamber with a second diameter is formed, said second diameter being at least 1.5 times the first diameter (see figures 1 and 4).

Thus claim 1 is not acceptable for lack of novelty.

Moreover, each of the documents D2 (movable rollers 26, 28, 30, 32, 34, 36, 38; see figure 1), D3 (movable rollers 21, 22; see figures 1 and 3; the starting baling chamber adopts a substantially cylindrical shape whenever the product starts to push the pressing belt 32) and D4 (movable rollers 44, 45; see figures

1 and 2; the starting baling chamber adopts a substantially cylindrical shape whenever the product starts to push the pressing belt 20) discloses as well the whole of the subject-matter of claim 1.

- 2 Dependent claims 2, 3, 5, 6, 7, 10, 11, 15, 16 and 18 seem to be disclosed in the above mentioned documents (for claim 2: see D1, pair of rollers 11, or D2, individually movable rollers 26, 28, 30, 32, 34, 36, 38, or D3, movable pair of rollers 21, 22, or D4, movable pair of rollers 44, 45; for claim 3: see D1, flexible means 42; for claim 5: see figures of any of D1, D2, D3 or D4 where movement of the rollers is disclosed; for claim 6: see the means for displacing the movable rollers towards their initial position in any of D1, D2, D3 or D4; for claim 7: see D1, supports 9 and 10; for claims 10 and 11: see mechanisms for enabling movement of the movable rollers in any of D1, D2, D3 or D4; for claim 15: see figure 1 of D1 or D2; for claim 16: see figures of any of D1, D2, D3 or D4).

Thus claims 2, 3, 5, 6, 7, 10, 11, 15, 16 and 18 are not acceptable for lack of novelty.

- 3 The subject-matter of claims 4, 8, 9, 12, 13, 14 and 19 is not disclosed by any of the cited documents, and it does not result in an obvious manner from any combination of those.

Item VII

Documents D1 and D2 should be identified in the description and the relevant background art disclosed therein should be briefly discussed.

Item VIII

- 1 Claim 1 claims "Een baalvormende inrichting" comprising "een baalvormende inrichting".

The fact that the claimed device comprises a device which seems to be the same as the claimed one renders the subject-matter of claim 1 unclear.

- 2 Claim 7 claims that the rollers are arranged on "een twee rasters".

The inconsistency concerning the number of "rasters" renders the scope of protection of claim 7 unclear.

- 3 Some features contained in particular dependent claims are referred to as having been cited in claim 1, however this is not the case for the following terms: "de binnenste positie" in claim 9, "de twee rasters" in claim 12, and also "de ene of meerdere actuatoren" in claim 19.

This lack of previous reference to such features leaves the reader in doubt as to the meaning of the technical features to which they refer, thereby rendering the definition of the subject-matter of said claims unclear.