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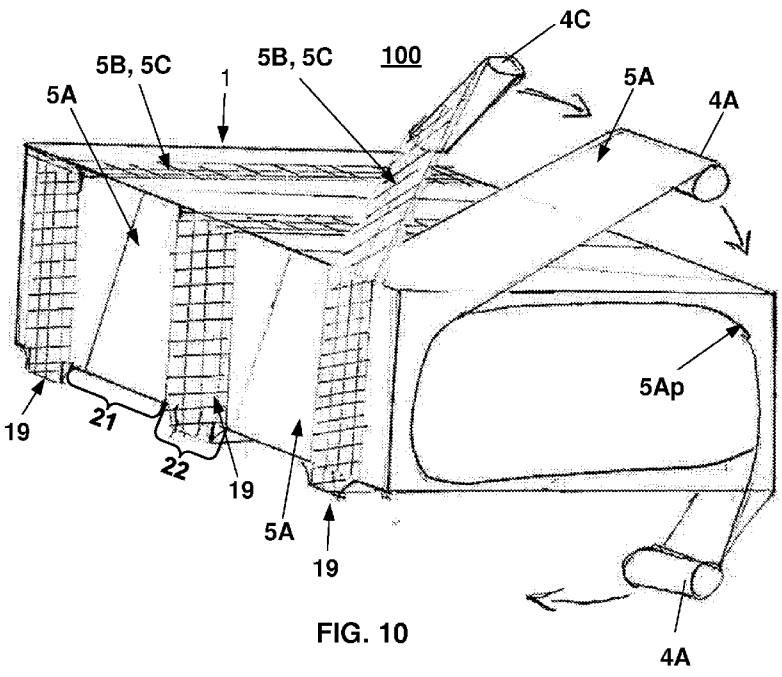


FIG. 10

(57) **Abstract**: An apparatus (100) for producing wrapped bales (1) comprises first and second wrapping material dispenser means (4A, 4B, 4C) for dispensing wrapping material (5A, 5B, 5C) on the bales. It also comprises a wrapping means (6) for circulating the first and second wrapping material dispenser means (4A, 4B, 4C) in a first plane of rotation around said bale (3) for wrapping said web of wrapping material (5A, 5B, 5C) around said bale (3). The apparatus is further configured to emerge the first wrapping material (5A) from the first wrapping material dispenser means (4A) and the second wrapping material (5B, 5C) from the second wrapping material dispenser means (4B, 4C) around the bale at least in two different areas (21, 22) so that the properties of the final wrapping of at least one of said first and/or second wrapping material (5B, 5C) provided onto the bale differs substantially at least in the second area (22) from the properties of the final wrapping of at least one of said first and/or second wrapping material (5A) in said first area (21) in order to make the bale wrapping stronger in said second area.

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METHOD AND APPARATUS FOR PRODUCING WRAPPED BALES

TECHNICAL FIELD OF THE INVENTION

The invention relates to a method and apparatus for producing wrapped bales. Especially the invention relates to a method and apparatus for wrapping the bales with a web-like wrapping material.

BACKGROUND OF THE INVENTION

Different methods are known from prior art for wrapping an article with a web-like wrapping material. For example WO/1994/022717 presents a solution where an article is in one stage moved past wrapping means while the wrapping means provided with a dispenser means are rotated around the article along a circular path in a first plane of rotation. In a further stage of wrapping the article is rotated by rotating means in a second plane of rotation substantially normal to said first plane of rotation. Between the stages the surface of the wrapping material web is turned about 90° such that the surface of the web is always substantially normal to said planes of rotation in both stages.

There are however some disadvantages relating to the known prior art, such as using special wires to mechanically bound the wrapped articles e.g. in particular points, often at the location of supporting battens. Typically these wires are made of metal, which causes problems when the article is opened in a final disposing plant, like in a power plant where the contents of the wrapped article is burned. In addition one disadvantage in the known prior art is a consumption of the web-like wrapping material and additionally production of certain stronger areas onto the article to be wrapped. These areas to be stronger than another areas includes e.g. end portions of the article or a support portions, such as supporting structures arranged below or around the article, which are either made of the aforementioned metal wires.

SUMMARY OF THE INVENTION

An object of the invention is to alleviate and eliminate the problems relating to the known prior art. Especially an object of the invention is to provide a wrapping method and apparatus for wrapping the bales and providing stronger supporting areas without the need of additional wires around the bale. In addition an object of the invention is to consume less wrapping material than the known prior art solutions.

The object of the invention can be achieved by the features of independent claims.

The invention relates to a method for producing wrapped bales according to claim 1. In addition the invention relates to an apparatus for producing wrapped bales according to claim 13.

According to an embodiment of the invention a bale to be wrapped is receiving from a baling apparatus. The baling apparatus may be a separate apparatus from the wrapping apparatus of the invention. A first wrapping stage comprises moving the bale and a wrapping means in relation to each other so that the providing of the wrapping material onto the surface and along the bale around in its longitudinal (moving) direction is possible. The wrapping means comprises at least first and second wrapping material dispenser means, which are arranged to rotate around the bale in a circular path in a first plane of rotation. When circulating, a web of wrapping material emerges from the first and second wrapping material dispenser means advantageously such that said web of wrapping material becomes wrapped on the sides of the bale in a first direction of wrapping.

According to an embodiment of the invention the first wrapping material is emerged from the first wrapping material dispenser means and the second wrapping material is emerged from the second wrapping material dispenser means around the bale at least in two different areas of the bale in the first plane of rotation and in the direction perpendicular to the first plane of rotation. The emerging is advantageously arranged so that the properties, such as a width and/or tension, of the final wrapping of at least one of the first and/or second wrapping material, when provided or folded on the bale, differs substantially from each other.

For example, the first wrapping material may be emerged from the first wrapping material dispenser means with a first tension and the second

wrapping material from the second wrapping material dispenser means with a second tension, where said first and second tensions differs from each other. By this a lamination or areas with different strengths can be achieved. Especially it is to be noted than e.g. the first wrapping material (being e.g. rigid or non-stretchable) can be laminated to the surface of the bale or other object by the second wrapping material (being e.g. stretchable) when the second wrapping material is emerged from the second wrapping material dispenser means with a second tension being more tighter than the first tension used for the first wrapping material, which is a clear advantage over the known prior art.

In addition, according to an example the properties, such as a width and/or tension, of the final wrapping of at least one of the first and/or second wrapping material, when provided or folded on the bale, may differ substantially at least in the second area from the properties when of at least one of the first and/or second wrapping material provided or folded in the first area in order to make the bale wrapping stronger in said second area. For example the width of the second wrapping material may be substantially less than the width of the first wrapping material at least in the second area than in the first area or the tensions of the wrapping materials may vary in different areas.

As an example the only second wrapping material is narrower in said second area than in said first area. According another example the first or both of the wrapping materials (the first and the second) are narrower in said second area than in said first area.

According to an embodiment the width of the second wrapping material provided onto the second area is originally narrower already when being on the dispenser means so that width of the second wrapping provided onto the second area is essentially the same as the width of the original second wrapping material on the dispenser means.

According to an another embodiment the width of the first and/or second wrapping material provided onto the second area is achieved from the original wrapping material by tilting at least one of the wrapping material dispenser means in relation to the normal of the first plane of rotation in the second area so that the normal of the surface of the web of the wrapping material differs substantially of the normal of the first plane of rotation before

wrapping so before the wrapping material web touches the surface of the bale. In addition the narrowing of the first and/or second wrapping material can be achieved by mechanically shrinking the original wrapping material narrower before wrapping, and/or thermally shrinking the original wrapping material before wrapping.

In addition according to an embodiment the second area is provided with more rounds of at least the second wrapping material than said first area in order to make the bale wrapping stronger in said second area. In addition, and especially if the first dispenser means is also tilted so that the first wrapping material web is also narrower in said second area than in said first area, the second area may also be provided with more rounds of the first wrapping material than said first area.

According to an example the width of the second wrapping material in said second area is less than 75%, more advantageously less than 60% and most advantageously less than 50% of the width of the first wrapping material at least in said second area. Still according to an example the width of the narrower (first and/or second) wrapping material, in particularly of the second wrapping material in said second area is less than 75%, more advantageously less than 60% and most advantageously less than 50% of the width of the first wrapping material at least in said first area.

According to an embodiment the moving of the bale is slowed or stopped in the position where the second wrapping material is provided to the second area. This allows to make more rounds of the wrapping material to the second area and thereby to produce more stronger wrapping to the bale in said second area.

Optionally the wrapping may also comprise additionally wrapping the web of at least the first and optionally also the second wrapping material onto a frame means by wrapping means. In this stage the frame means and the wrapping means are moved in relation to each other to form a tunnel construction, which advantageously comprises the wrapping material. In addition the bale (or the wrapping means) is then moved in the direction perpendicular to the first plane of rotation and at least partly into the tunnel construction comprising said wrapping material so to attach the tunnel construction of the wrapping material to the bale. By this way the wrapping

material can be easily and effectively attached to the bale surface to be wrapped.

The first and second wrapping material dispenser means with the wrapping material are advantageously arranged, for example tilted or providing narrower second material and aligned so that the second wrapping material is emerged essentially onto and over the frame means and the first wrapping material is emerged only partly onto or over the frame means and so that the proximal end of the first wrapping material (furthest end of the first material in the direction of the movement of the bale) is emerged outside or beyond the frame means in the moving direction of the bale so to form the end of the tunnel construction.

The second area may be any area on the bale, which is or must be done by wrapping structurally stronger than another area. Examples of the second area are e.g. a portion of the bale having a supporting structure, such as a batten, and the end portions of the bale, which are exposed to higher loading e.g. during handling and transportation of the bale. In addition the second area may be provided by the wrapping material also onto the frame means of the wrapping apparatus to make stronger tunnel construction, which is then attached to the end portion of the bale.

Optionally the bale can also be wrapped in a second plane of rotation which is substantially normal to said first plane of rotation. For this the bale is turned after the first stage so to provide wrapping onto the sides of said bale in a second direction of wrapping substantially normal to said first direction of wrapping. In this embodiment the surface of the web of wrapping material emerging from the dispenser means is also turned between the first wrapping step and the second wrapping step such that the web surface becomes substantially parallel with the first plane of rotation so that said wrapping means remains in the first plane of rotation thereof. For the second wrapping step the second wrapping material may be cut before providing the first wrapping material onto the sides of the bale in said second direction.

The present invention offers advantages over the known prior art, such as removing the need of using special wires to mechanically bound the wrapped bales e.g. in particular points, such as at the location of supporting battens or ends of the bales. In addition according to embodiments of the

invention the consumption of the wrapping material can be decreased because the second areas, so the portions of the bale which must be tied stronger, can be produced by narrower wrapping material, which means that these areas can be produced by less wrapping material (mass). For example the typical wrapping apparatus can save even 300 000 kilos wrapping material when using the narrower second wrapping material (250-300 mm) instead of “normal” first wrapping material (750 mm).

In addition the second wrapping material may be tighter, but also thicker and/or more inextensible than the first wrapping material, whereupon the second area can be provided much stronger than the first area with minimal second wrapping material. In addition the dispensing means can carry more meters of narrower second wrapping material than wider first wrapping material (loading capacity is in kilos). Moreover when the properties of the first and second wrapping material differ from each other, also laminate structures can be achieved onto the surface of bale by the invention. Furthermore when the wrapping materials are emerged from different wrapping material dispenser means, for example the tension of the different wrapping materials can be adjusted optimally by the different dispenser means, whereupon e.g. the lamination can be performed optimally so that e.g. more elastic wrapping material is wrapped tightly around the bale and at the same time the more rigid wrapping material is wrapped around the bale for providing stronger mechanical support structure. In addition the lamination can be done much easier and effectively when the two different wrapping materials are tight around the bale and thereby also coupled to each other tensions optimal for each material.

The exemplary embodiments presented in this text are not to be interpreted to pose limitations to the applicability of the appended claims. The verb "to comprise" is used in this text as an open limitation that does not exclude the existence of also unrecited features. The features recited in depending claims are mutually freely combinable unless otherwise explicitly stated.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific example embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Next the invention will be described in greater detail with reference to exemplary embodiments in accordance with the accompanying drawings, in which:

Figures 1-6 illustrate a principle of an exemplary apparatus for producing wrapped bales (first and second stages) with a web-like wrapping material by sequential figures according to an advantageous embodiment of the invention,

Figures 7-8 illustrate a principle of exemplary parts of the first and second stages of wrapping as seen from one end of the apparatus according to an advantageous embodiment of the invention, and

Figures 9-10 illustrate two principles of providing two different areas of wrapping onto the bale according to advantageous embodiments of the invention.

DETAILED DESCRIPTION

Figures 1-6 illustrate a principle of an exemplary apparatus 100 for producing wrapped bales 1 with a web-like wrapping material 5A, 5B, 5C by sequential figures according to an advantageous embodiment of the invention, wherein the apparatus is configured to receive a bale from a bale producing means 2 for producing bales 3 (raw bale without wrapping). The bale 3 can contain e.g. straw, fodder, cotton, branch, pulp or waste, however not limiting to those only. The apparatus comprises also at least first and second wrapping material dispenser means 4A, 4B, 4C for dispensing a web of wrapping material 5A, 5B, 5C, as well as a wrapping means 6 for circulating said first and second wrapping material dispenser means 4A, 4B, 4C in a first plane of rotation around the bale 3 for wrapping the web of wrapping material 5A, 5B, 5C around the bale 3.

The apparatus may also be provided with a moving means for moving the bale 3 and the wrapping means 6 in relation to each other such that the bale

3 is moved past said wrapping means 6 in a direction essentially perpendicular to said first plane of rotation (arrow on the bales 3 in Figures). The moving means comprises or is configured to be coupled with a tunnel means 9 for receiving bales 3 from the bale producing means 2. The tunnel means 9 comprises an open downstream end 10.

The apparatus comprises advantageously also a frame means 11. The frame means 11 and the wrapping means 6 are movable in relation to each other such that the wrapping means 6 is capable of applying at least of of said wrapping material 5A, 5B, 5C onto the frame means 11 to form a tunnel construction 12 comprising wrapping material 5. The frame means 11, on which wrapping material 5A, 5B, 5C is applied to form a tunnel construction 12 or on which wrapping material 5A, 5B, 5C is to be applied to form a tunnel construction 12, is arrangable in relation to the open downstream end 10 of the tunnel means so that the open downstream end 10 of the tunnel means 9 is or becomes situated inside a the tunnel construction 12 comprising wrapping material 5A, 5B, 5C, so that a bale 3 that is moved out of the open downstream end 10 of the tunnel means 9 is moved into a tunnel construction 12 comprising wrapping material 5A, 5B, 5C, which tunnel construction 12 becomes part of the wrapping or the wrapping capable of at least partly holding the material of the bale 3 together.

The tunnel construction 12 can be formed when the frame means 11 is arranged in such position in relation to the open downstream end 10 of the tunnel means 9 so that the tunnel construction 12 comprising wrapping material 5A, 5B, 5C is formed around the open downstream end 10 of the tunnel means 9 by applying wrapping material 5A, 5B, 5C at the frame means 11 so that the open downstream end 10 of the tunnel means 9 will become situated in the tunnel construction 12 that is formed.

Alternatively, the tunnel construction 12 may initially be formed at a distance from the open downstream end 10 of the tunnel means 9 and thereafter the tunnel construction 12 can be moved in relation to the open downstream end 10 of the tunnel means 9 so that the open downstream end 10 of the tunnel means 9 will become situated in the tunnel construction 12.

In an apparatus as the one shown in the figures the frame means 11 may be movable both in relation to the wrapping means 6 and in relation to the tunnel means 9 (when used) in such a way that the frame means 11 is firstly

perpendicularly movable in relation to a first plane of rotation of the dispenser means 4A, 4B, 4C of the wrapping means 6 so that wrapping material is applied at the sides of the frame means 11 while moving the frame means 11 in relation to the wrapping means to form the tunnel construction 12 comprising wrapping material 5A, 5B, 5C onto the frame means and in such a way that the tunnel construction 12 formed onto the frame means 11 is thereafter movable in relation to the tunnel means 9 so that the open downstream end 10 of the tunnel means 9 is situated inside the tunnel construction 12 comprising wrapping material 5A, 5B, 5C.

However, according to an example the frame means 11 may also be stationary, whereupon the wrapping material will slip off from the frame means 11 when the bale is transferred through or from the wrapping means 6 and/or the tunnel means 9 (when used).

According to an embodiment the first and second wrapping material dispenser means 4A, 4B, 4C of the wrapping means 6 with the wrapping material are arranged in relation to each other so that the second wrapping material 5B, 5C is emerged essentially wholly onto the frame means 11 and the first wrapping material 5A is emerged only partly onto the frame means 11 and the proximal end 5Ap (so the furthest end of the material 5Ap in the direction of the movement of the bale) of the first wrapping material 5A is emerged outside or over the frame means 11 in the moving direction of the bale so to form the end of the tunnel construction 12 (as can be seen in Figure 9 and 10).

The frame means 11 comprises preferably, but not necessarily, bars, rods 18, or similar elongate elements. One purpose of the frame means 11 is to provide such a support for the tunnel construction 12 comprising wrapping material 5A, 5B, 5C so that when the bale 3 is at least partly moved into the tunnel construction 12, the frame means 11 enables the wrapping material 5A, 5B, 5C of the tunnel construction 12 to be in contact with the bale 3 so that the wrapping material 5A, 5B, 5C of the tunnel construction 12 is capable of at least partly retaining the structure of the bale 3. This is important because the tunnel construction 12 will become the final wrapping for the bale 3 or part of the final wrapping for the bale 3.

In one embodiment of the invention the frame means 11 comprises four rods 18 which are arranged in relation to each other so that wrapping

material 5A, 5B, 5C applied with said wrapping means 6 onto the frame means 11 forms a tunnel construction 12 having a rectangular cross-shape and that is supported by said four rods 18.

The apparatus may also comprise a rotation means 8 for rotating the bale 3 in a second plane of rotation substantially normal to said first plane of rotation.

According to an embodiment the first wrapping material dispenser means 4A is configured to emerge the first wrapping material 5A with a first tension and the second wrapping material dispenser means 4B, 4C is configured to second emerge the second wrapping material 5B, 5C with a second tension, where said first and second tensions differs from each other, as is described elsewhere in this document.

Figures 7-8 illustrate a principle of exemplary parts of the first and second stages of wrapping as seen from one end of the apparatus according to an advantageous embodiment of the invention. As can be seen in Figures 7-8 the wrapping means 6 comprises also a circular ring 13 which is rotatably assembled onto a support roller means 14 disposed in a framework 15 of the apparatus which circular ring 13 preferably further includes a support arm 16 extending from the circular ring 13 for pivotally supporting said dispenser means 4A, 4B, 4C.

The circular ring 13, the support roller means 14, the framework 15 and the support arm 16 correspond preferably, but not necessarily, to the circular ring 13, the support roller means 14, the framework 15 and the support arm 16 presented and described in publication WO/1994/022717 or EP2496068B1. The apparatus may also comprise a conveyor means 17 for additionally conveying the bale.

The apparatus 100 may comprise furthermore a turning or tilting means 7 for turning or tilting the surface of at least one web of wrapping material 5A, 5B, 5C emerging from the dispenser means 4A, 4B, 4C in relation to said first plane of rotation. The turning or tilting can be done for changing the angle of the surface of the emerging wrapping material web so that the emerging wrapping material web meets the bale in an angle and thus produces narrower (and this denser) wrapping on the bale than when the surface of the emerging wrapping material web is substantially normal to

said first plane of rotation. The turning or tilting is also done advantageously between a first wrapping stage and a second wrapping stage such that the surface of said web of wrapping material 5A becomes substantially parallel with said first plane of rotation, wherein said turning means 7 for turning said surface of said web of wrapping material 5A is arranged such said wrapping means 6 remains in said first plane of rotation.

It is to be noted that the apparatus advantageously comprises a braking or resisting device 23 arranged in connection with at least one of said first and second dispenser means 4A, 4B, 4C in order to control the tension of the wrapping material during emerging. The braking or resisting device 23 can be implemented e.g. by a controllable electric motor, mechanical or hydraulic or pneumatic brakes, induction brakes or a friction braking device by which the tension of the emerging wrapping material can be controlled, as is described elsewhere in this document.

Figures 9-10 illustrates two principles of providing two different areas of wrapping onto the bale according to advantageous embodiments of the invention, where the wrapping apparatus 100 is configured to emerge the first wrapping material 5A from the first wrapping material dispenser means 4A and the second wrapping material 5B, 5C from the second wrapping material dispenser means 4B, 4C around the bale 1 at least in two different areas 21, 22 of the bale in said first plane of rotation and in the direction perpendicular to said first plane of rotation so that the properties of the final wrapping of at least one of said first and/or second wrapping material 5B, 5C provided onto the bale are substantially different at least in the second area 22 than the properties of the final wrapping of at least one of said first and/or second wrapping material 5A in said first area 21 in order to make the bale wrapping stronger in said second area.

According to an advantageous embodiment the property of the first wrapping material 5A is different in the first area 21 that the property of the wrapping material 5B, 5C in the second area 22. It is to be noted that also the first wrapping material 5A can be provided into the second area 22 so that its properties, at least when or after contacted and folded on the bale, differs from the properties on the first area 21. The property is advantageously the width of the wrapping material, but may also be another property, such as the final density after provided onto the surface of the bale. The width and/or density or other property of the second wrapping

material 5B, 5C may differ already in originally from the property of the first wrapping material so before emerged. Also the emerging process can be controlled so that the width and/or density of the second wrapping material 5B, 5C after provided onto the surface of the bale is different on the second area 22 as in the first area 21. This can be done e.g. by turning or tilting (advantageously by the turning or tilting means 7) at least one of said wrapping material dispenser means 4C in relation to the normal of the first plane of rotation at least in said second area 22 so that the surface of said wrapping material web 5C emerged by said tilted wrapping material dispenser means 4C differs substantially of the normal of said first plane of rotation before wrapping, as can be clearly seen in Figure 10. In the embodiment described in Figure 10 the apparatus is thus configured to provide the wrapping material 5B, 5C onto the second area 22 so that the width said wrapping material 5B, 5C is reduced in relation to the width of said wrapping material 5B, 5C in said first area 21.

However, according to an embodiment the apparatus 100 is configured to keep the surface of the web of at least one wrapping material 5A substantially normal to the first plane of rotation during.

The narrowing of at least one wrapping material web 5B, 5C can also be done in other way than tilting the angle of emerging web. For this the apparatus may comprise a mechanical shrinking device for mechanically shrinking the original wrapping material 5B, 5C narrower for the second area 22 so that the width said wrapping material 5B, 5C is reduced in relation to the width of said wrapping material 5B, 5C in said first area. The apparatus may also comprise a heating device for heating the original wrapping material 5B, 5C narrower for the second area 22 (depending whether the wrapping material is heat shrinkable) so that the width said wrapping material 5B, 5C is reduced in relation to the width of said wrapping material 5B, 5C in said first area 21.

According to an embodiment the apparatus may also be configured to provide the second area 22 with more rounds of at least the second wrapping material 5B, 5C than said first area 21 in order to make the bale wrapping stronger in said second area. If and when the first wrapping material 5A is not cut (by a cutting device (not shown)) or otherwise manipulated in the second area 22, it 5A is also round as many rounds around the bale as the second wrapping material 5B, 5C. For this the

moving means is advantageously configured to move the bale and slow or stop the bale in the position where the second wrapping material is provided to the second area. Other option is to speeding up the rotations of the wrapping means 6.

Advantageously the apparatus is configured to provide the second area onto the portion of the bale comprising a supporting portion 19 (batten) and/or on the end portion(s) of the bale or onto the frame means.

The invention has been explained above with reference to the aforementioned embodiments, and several advantages of the invention have been demonstrated. It is clear that the invention is not only restricted to these embodiments, but comprises all possible embodiments within the spirit and scope of the inventive thought and the following patent claims. The features recited in dependent claims are mutually freely combinable unless otherwise explicitly stated. For example the apparatus for producing wrapped bales can be a stationary apparatus or a movable apparatus mounted for example on a trailer to be pulled by a tractor. In addition it can be operated in horizontal or vertical directions.

Claims

1. A method for producing wrapped bales (1), comprising steps of:
a receiving stage for receiving a bale to be wrapped,
- a first wrapping stage comprising moving the bale (3) and wrapping means (6) in relation to each other, said wrapping means (6) comprising at least first and second wrapping material dispenser means (4A, 4B, 4C), said wrapping material dispenser means (4A, 4B, 4C) being arranged to rotate around said bale (3) in a circular path in a first plane of rotation, whereby a web of wrapping material (5A, 5B, 5C) emerges from said first and second wrapping material dispenser means (4A, 4B, 4C) such that said web of wrapping material (5A, 5B, 5C) becomes wrapped on the sides of said bale (3) in a first direction of wrapping,

characterized in that the first wrapping stage comprises steps of
- emerging the first wrapping material (5A) from the first wrapping material dispenser means (4A) and the second wrapping material (5B, 5C) from the second wrapping material dispenser means (4B, 4C) around the bale at least in two different areas (21, 22) of the bale in said first plane of rotation and in the direction perpendicular to said first plane of rotation so that the properties of the final wrapping of at least one of said first and/or second wrapping material (5B, 5C) provided onto the bale differs substantially at least in the second area (22) from the properties of the final wrapping of at least one of said first and/or second wrapping material (5A) in said first area (21) in order to make the bale wrapping stronger in said second area (22).

2. The method according to claim 1, wherein the first wrapping material (5A) is emerged from the first wrapping material dispenser means (4A) with a first tension and the second wrapping material (5B, 5C) is emerged from the second wrapping material dispenser means (4B, 4C) with a second tension, where said first and second tensions differs from each other.

3. The method according to any of previous claims, wherein the width or tension of at least one of said first and/or second wrapping material (5B, 5C) is substantially less at least in the second area (22) than the width or tension of at least one of said first and/or second wrapping material (5A) in said first area (21) in order to make the bale wrapping stronger in said second area.

4. The method according to any of previous claims, wherein the width or tension of the first and/or second wrapping material (5B, 5C) provided onto the second area (22) is:

- the width or tension of the original wrapping material (5B), or
- the width or tension achieved from the original wrapping material (5B, 5C) by
    - tilting (7) at least one of said wrapping material dispenser means (4C) in relation to the normal of said first plane of rotation in the second area so that the surface of said web of wrapping material (5C) differs substantially of the normal of said first plane of rotation before wrapping,
    - mechanically shrinking the original wrapping material (5B, 5C) narrower before wrapping,
    - tightening or tensioning the original wrapping material (5B, 5C) by resisting the free emerging of the original wrapping material (5B, 5C) from the dispenser means (4B, 4C) and/or
    - thermally shrinking the original wrapping material (5B, 5C) before wrapping.

5. The method according to any of previous claims, wherein the second area (22) is provided with more rounds of at least the second wrapping material (5A, 5B, 5C) than said first area in order to make the bale wrapping stronger in said second area.

6. The method according to any of previous claims, wherein the width of the second wrapping material (5B, 5C) is less than 75%, more advantageously less than 60% and most advantageously less than 50% of the width of the first wrapping material (5A) at least in said second area.

7. The method according to any of previous claims, wherein the moving of the bale is slowed or stopped in the position where the second wrapping material is provided to the second area (22).

8. The method according to any of previous claims, wherein the first wrapping stage comprises additionally steps of:

- wrapping by means of said wrapping means (6) said web of at least the first and optionally also the second wrapping material (5A, 5B, 5C) onto a frame means (11), moving the frame means (11) and wrapping

means (6) in relation to each other to form a tunnel construction (12) comprising said wrapping material (5A, 5B, 5C), and

- moving the bale (3) in the direction perpendicular to said first plane of rotation and at least partly into the tunnel construction (12) comprising wrapping material (5A, 5B, 5C) to attach the tunnel construction (12) comprising wrapping material (5A, 5B, 5C) to the bale (3).

9. The method according to claim 8, wherein the first and second wrapping material dispenser means (4A, 4B, 4C) with the wrapping material are arranged so that the second wrapping (5B, 5C) material is emerged essentially onto the frame means (11) and the first wrapping material (5A) is emerged only partly onto the frame means (11) and the proximal end (5Ap) of the first wrapping material (5A) is emerged outside the frame means (11) in the moving direction of the bale so to form the end of the tunnel construction (12).

10. The method according to any of previous claims, wherein the second area is provided into the portion of the bale comprising a supporting portion and/or on the end portion(s) of the bale or onto the frame means (11) of any of claims 8-9.

11. The method according to any of previous claims, characterized by a second wrapping stage comprising turning said bale (3) in a second plane of rotation, which is substantially normal to said first plane of rotation, whereby the wrapping is provided onto the sides of said bale (3) in a second direction of wrapping substantially normal to said first direction of wrapping, and turning said surface of said web of wrapping material (5A) emerging from said dispenser means (4A) between said first wrapping step and said second wrapping step such that said web surface becomes substantially parallel with said first plane of rotation so that said wrapping means (6) remains in said first plane of rotation thereof.

12. The method according to claim 11, wherein the method comprises a step of cutting the second wrapping material (5B, 5C) before providing the first wrapping material (5A) onto the sides of the bale (3) in said second direction.

13. An apparatus (100) for producing wrapped bales (1), said apparatus being configured to receive a bale to be wrapped, and the apparatus comprising:

- at least first and second wrapping material dispenser means (4A, 4B, 4C) for dispensing a web of wrapping material (5A, 5B, 5C),
- wrapping means (6) for circulating said first and second wrapping material dispenser means (4A, 4B, 4C) in a first plane of rotation around said bale (3) for wrapping said web of wrapping material (5A, 5B, 5C) around said bale (3) and
- moving means for moving said bale (3) and said wrapping means (6) in relation to each other such that said bale (3) is moved past said wrapping means (6) in a direction essentially perpendicular to said first plane of rotation,

characterized in that the apparatus is configured to

- emerge the first wrapping material (5A) from the first wrapping material dispenser means (4A) and the second wrapping material (5B, 5C) from the second wrapping material dispenser means (4B, 4C) around the bale at least in two different areas (21, 22) of the bale in said first plane of rotation and in the direction perpendicular to said first plane of rotation so that the properties of the final wrapping of at least one of said first and/or second wrapping material (5B, 5C) provided onto the bale differs substantially at least in the second area (22) from the properties of the final wrapping of at least one of said first and/or second wrapping material (5A) in said first area (21) in order to make the bale wrapping stronger in said second area (22).

14. The apparatus of claim 13, wherein the first wrapping material dispenser means (4A) is configured to emerge the first wrapping material (5A) with a first tension and the second wrapping material dispenser means (4B, 4C) is configured to second emerge the second wrapping material (5B, 5C) with a second tension, where said first and second tensions differs from each other.

15. The apparatus of any of claims 13-14, wherein the apparatus comprises a braking or resisting device (23) arranged in connection with at least one of said first and second dispenser means (4A, 4B, 4C) in order to control the tension of the wrapping material during emerging.

16. The apparatus of any of claims 13-15, wherein the width of at least one of said first and/or second wrapping material (5B, 5C) is substantially less at least in the second area (22) than the width of at least one of said first and/or second wrapping material (5A) in said first area (21) in order to make the bale wrapping stronger in said second area (22).

17. The apparatus of any of claims 13-14, wherein at least one of said wrapping material dispenser means (4C) is tiltable in relation to the normal of said first plane of rotation at least in said second area so that the surface of said web of wrapping material (5C) emerged by said tilted wrapping material dispenser means (4C) differs substantially of the normal of said first plane of rotation before wrapping, whereupon the apparatus is configured to provide the wrapping material (5B, 5C) provided onto the second area (22) so that the width said wrapping material (5B, 5C) is reduced in relation to the width of said wrapping material (5B, 5C) in said first area (21).

18. The apparatus of any of claims 13-17, wherein the apparatus comprises a mechanical shrinking device for mechanically shrinking the original wrapping material (5B, 5C) narrower onto the second area (22) so that the width said wrapping material (5B, 5C) is reduced in relation to the width of said wrapping material (5B, 5C) in said first area (21); and/or wherein the apparatus comprises a heating device for heating the original wrapping material (5B, 5C) narrower onto the second area so that the width said wrapping material (5B, 5C) is reduced in relation to the width of said wrapping material (5B, 5C) in said first area.

19. The apparatus of any of claims 13-18, wherein the apparatus is configured to provide the second area with more rounds of at least the second wrapping material (5B, 5C) than said first area in order to make the bale wrapping stronger in said second area.

20. The apparatus of any of claims 13-19, wherein the moving means is configured to move the bale and slow or stop the bale in the position where the second wrapping material is provided to the second area (22).

21. The apparatus of any of claims 13-20, wherein

- said wrapping means (6) is configured to provide said web of at least the first and optionally the second wrapping material (5A, 5B, 5C) onto a frame means (11), the frame means (11) and wrapping means

(6) being arranged to be movable in relation to each other to form a tunnel construction (12) comprising said wrapping material (5A, 5B, 5C), and

- said moving means is configured to move the bale (3) in the direction perpendicular to said first plane of rotation and at least partly into the tunnel construction (12) comprising wrapping material (5A, 5B, 5C) to attach the tunnel construction (12) comprising wrapping material (5A, 5B, 5C) to the bale (3).

22. The apparatus of any of claims 21, wherein the first and second wrapping material dispenser means (4A, 4B, 4C) of the wrapping means (6) with the wrapping material are arranged in relation to each other so that the second wrapping material (5B, 5C) is emerged essentially wholly onto the frame means (11) and the first wrapping material (5A) is emerged only partly onto the frame means (11) and the proximal end (5Ap) of the first wrapping material is emerged outside the frame means (11) in the moving direction of the bale so to form the end of the tunnel construction (12).

23. The apparatus of any of claims 13-22, wherein the apparatus is configured to provide the second area (22) onto the portion of the bale comprising a supporting portion (18) and/or on the end portion(s) of the bale or onto the frame means (11) of any of claims 21-22.

24. The apparatus according to any of the claims 13-23, wherein the said wrapping means (6) comprises a substantially vertically disposed circular ring (13) which is rotatably assembled onto a support roller means (14) disposed in a framework (15) of the apparatus which circular ring (13) preferably further includes a support arm (16) extending from said circular ring (13) for pivotally supporting said dispenser means (4A, 4B).

25. The apparatus according to any of the claims 13-24, wherein the apparatus comprises a turning means (7) for turning said surface of said web of wrapping material (5A) emerging from said dispenser means (4A) between a first wrapping stage and a second wrapping stage such that the surface of said web of wrapping material (5A) becomes substantially parallel with said first plane of rotation, wherein said turning means (7) for turning said surface of said web of wrapping material (5A) is arranged such said wrapping means (6) remains in said first plane of rotation, and by rotation

means (8) for rotating said bale (3) in a second plane of rotation substantially normal to said first plane of rotation.

26. The apparatus according to any of the claims 25, wherein the apparatus comprises a cutting device for cutting the second wrapping material (5B) before providing the first wrapping material (5A) onto the sides of the bale (3) in said second direction in the second wrapping stage.

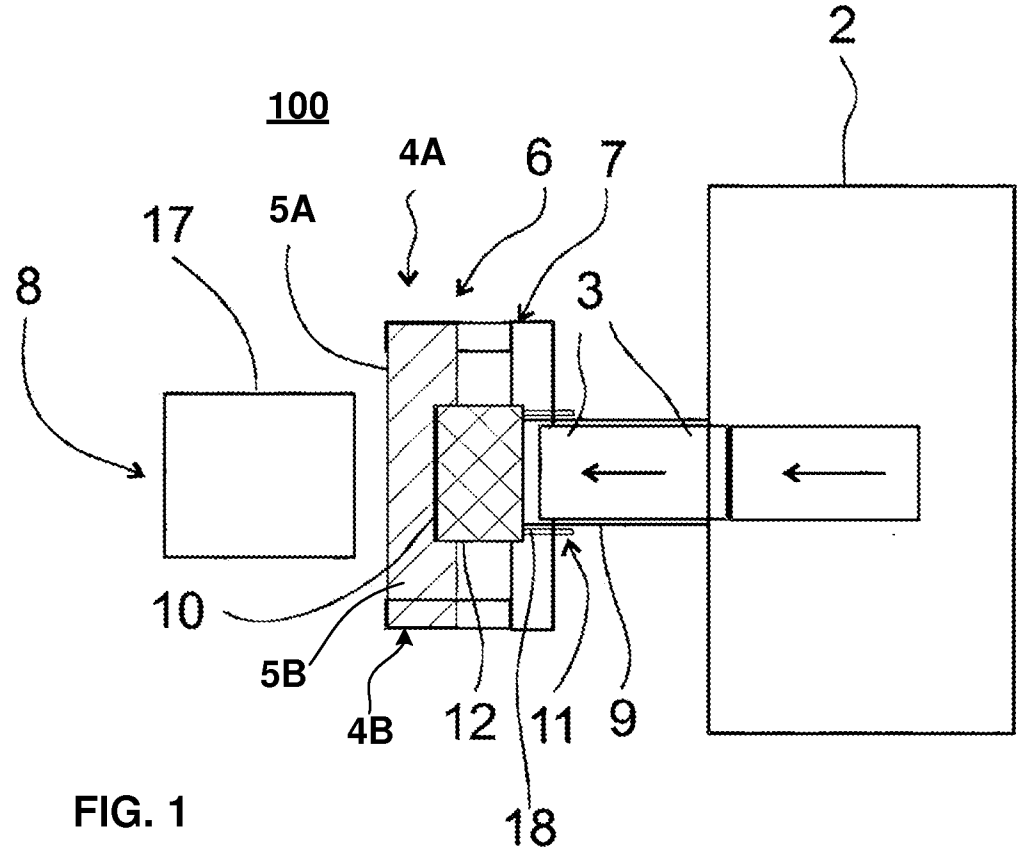

100
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4A
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7
17
5A
8
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5B
4B
12
11
9
18

FIG. 1

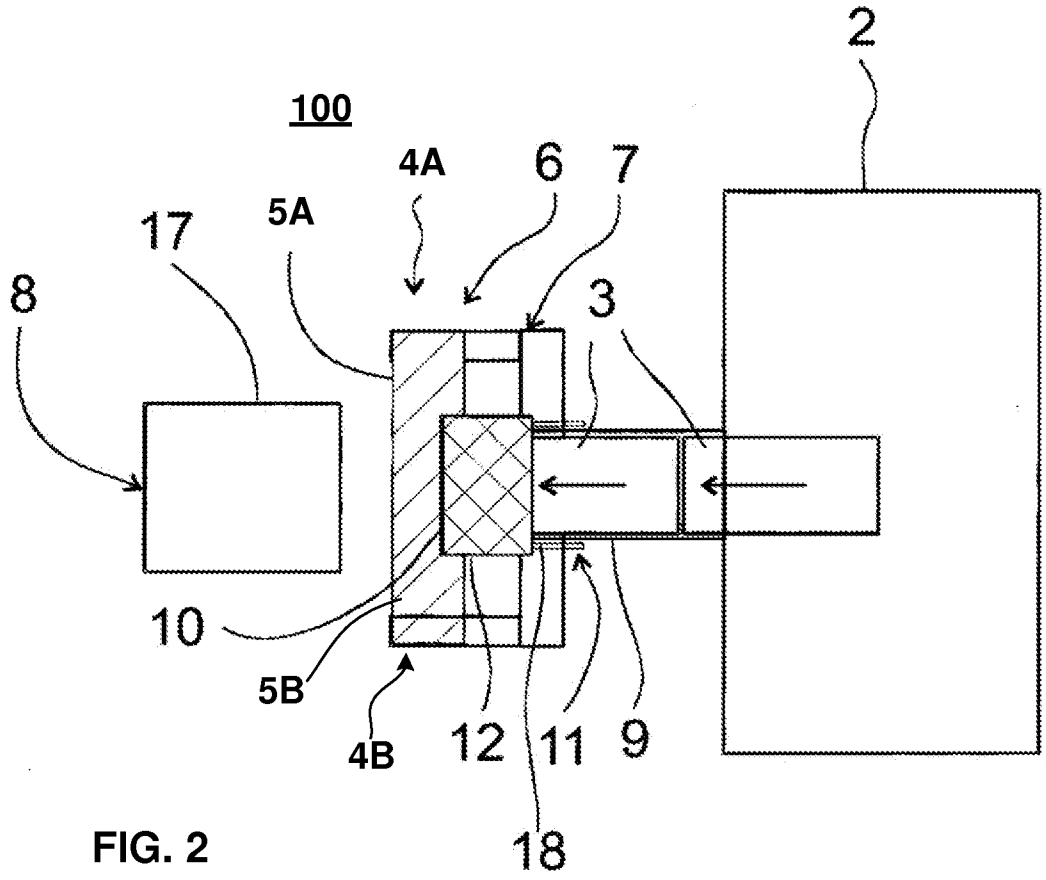

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FIG. 2

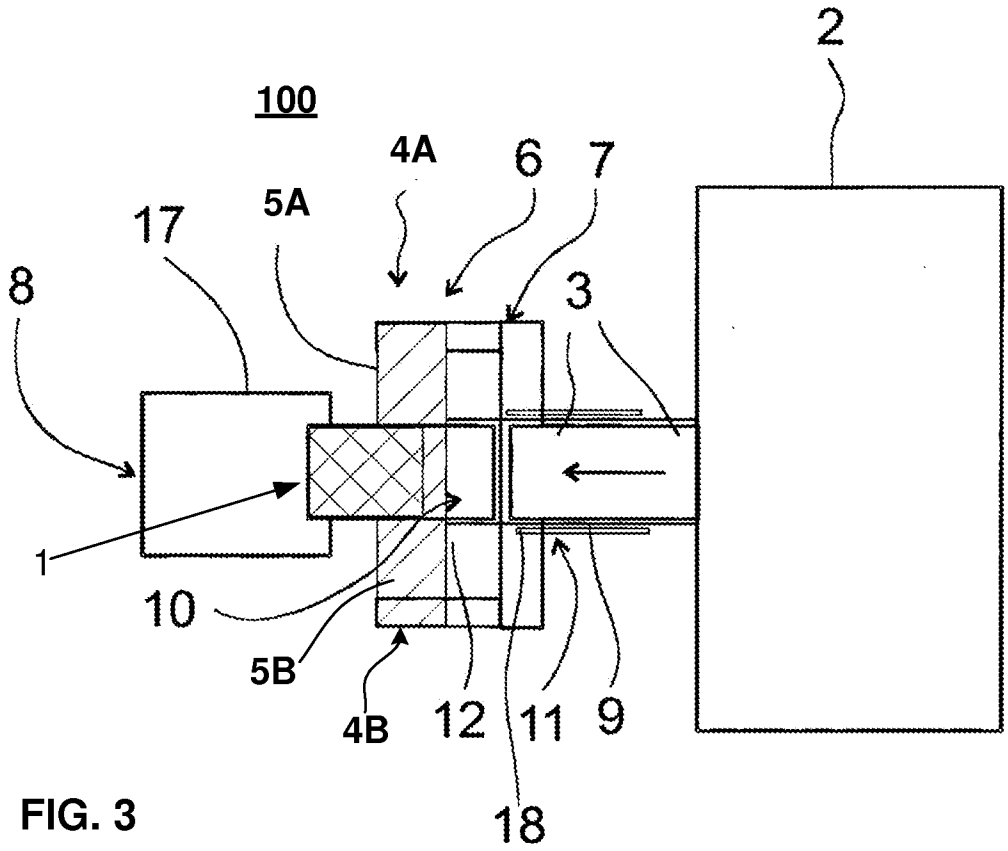

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FIG. 3

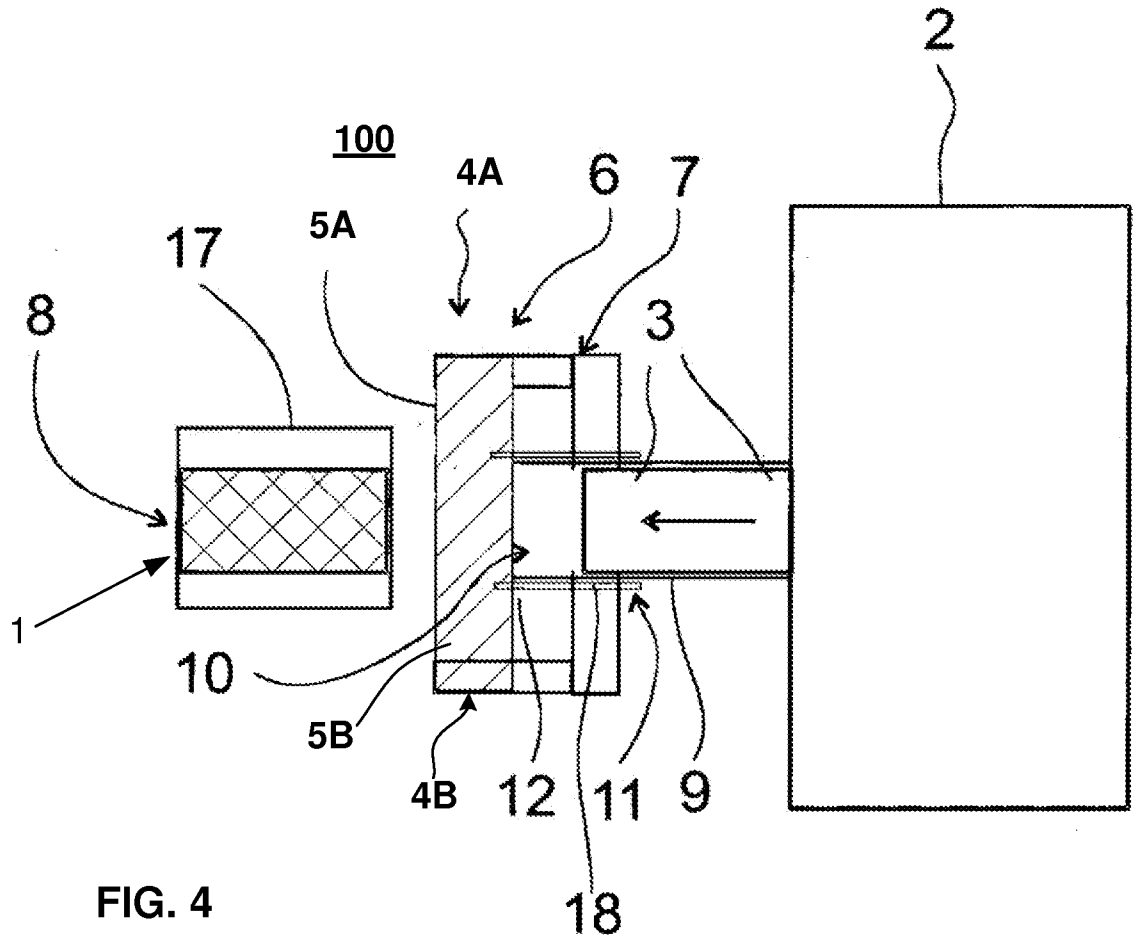

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FIG. 4

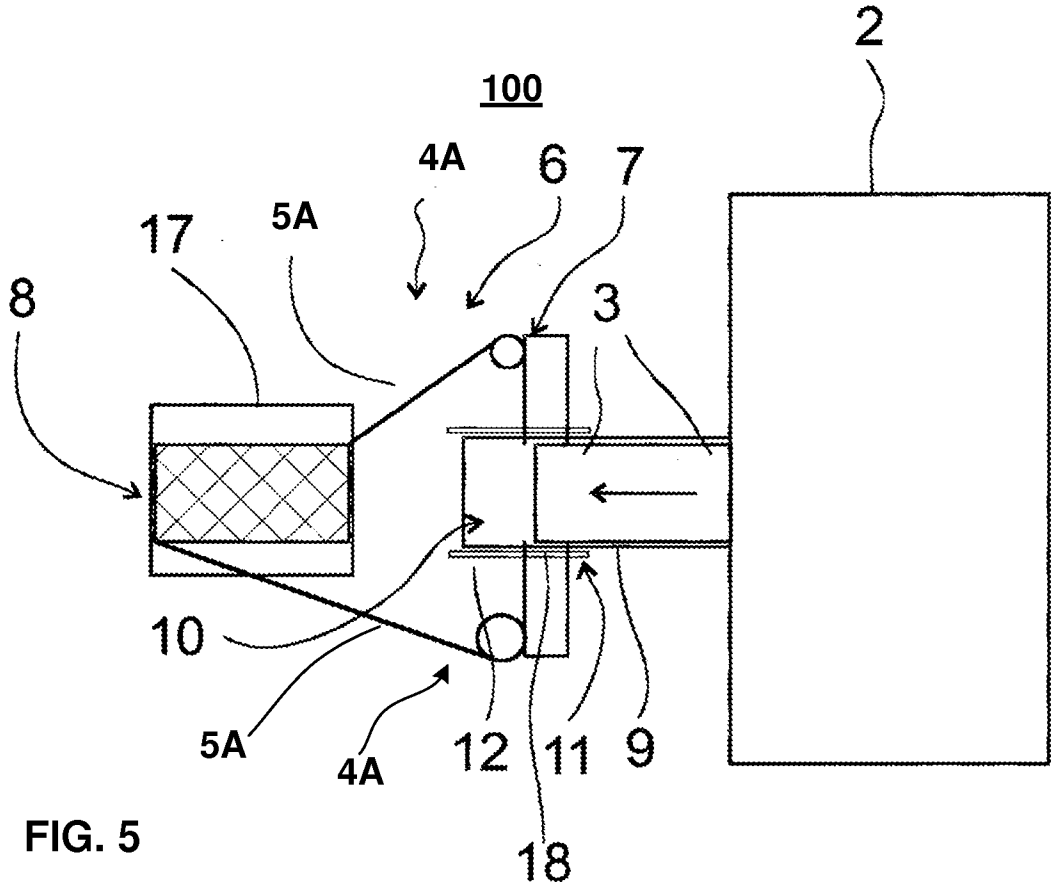

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FIG. 5

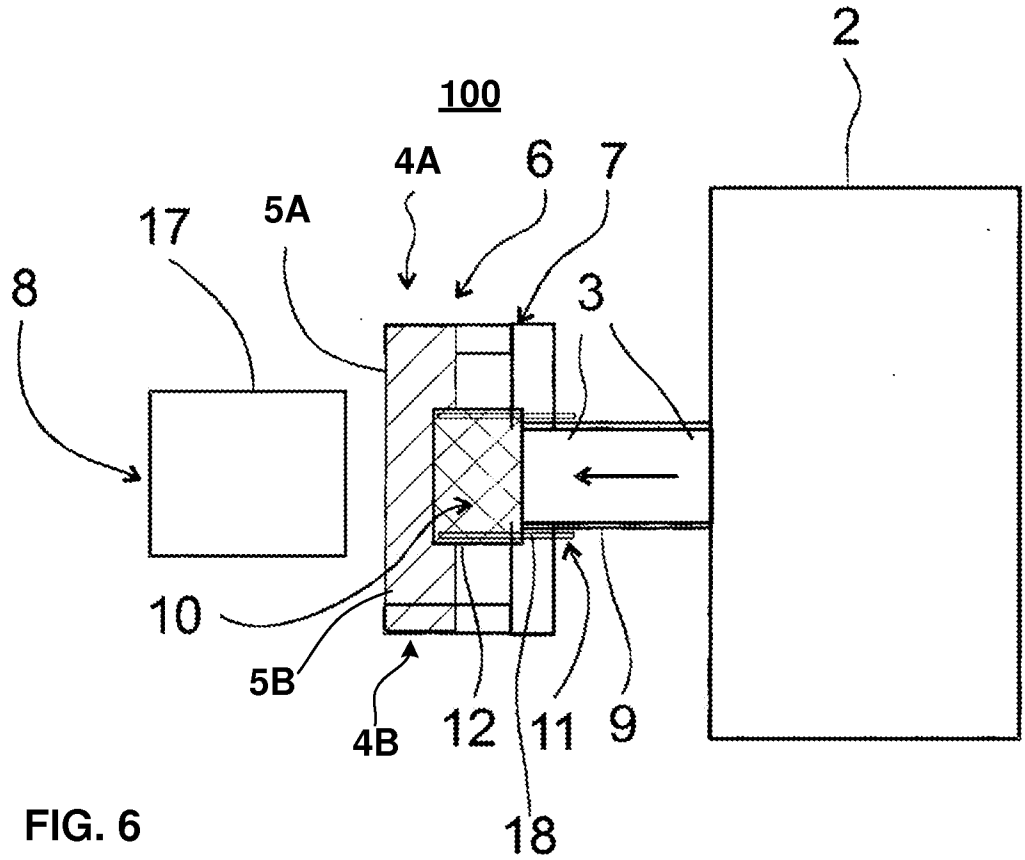

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9
18

FIG. 6

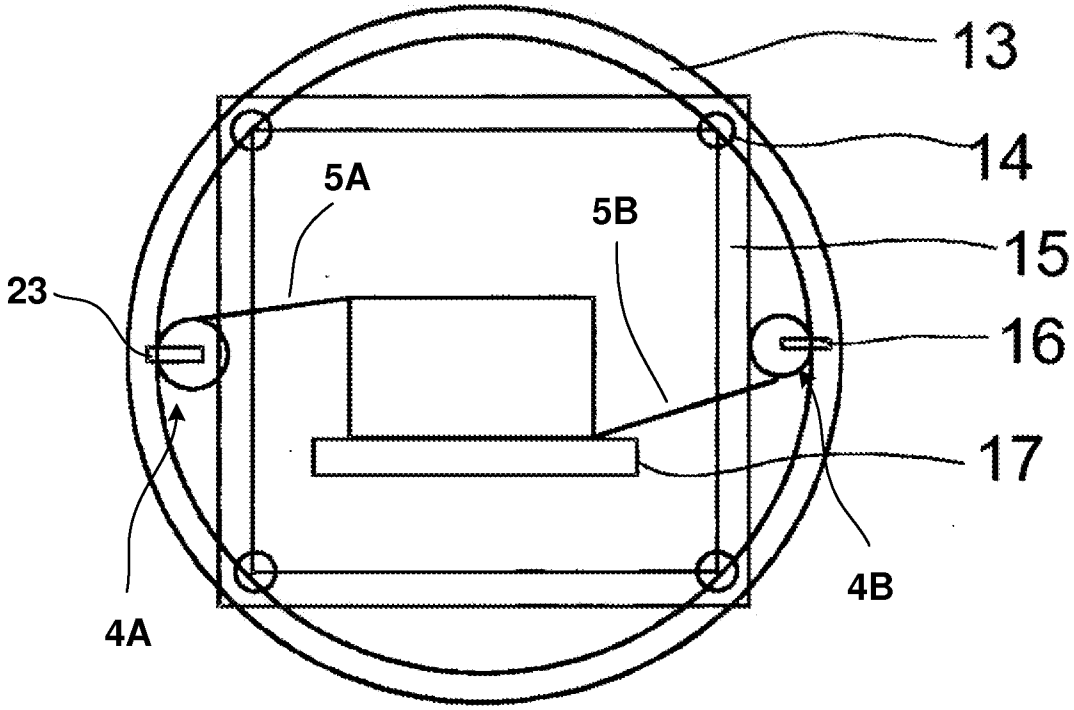


FIG. 7

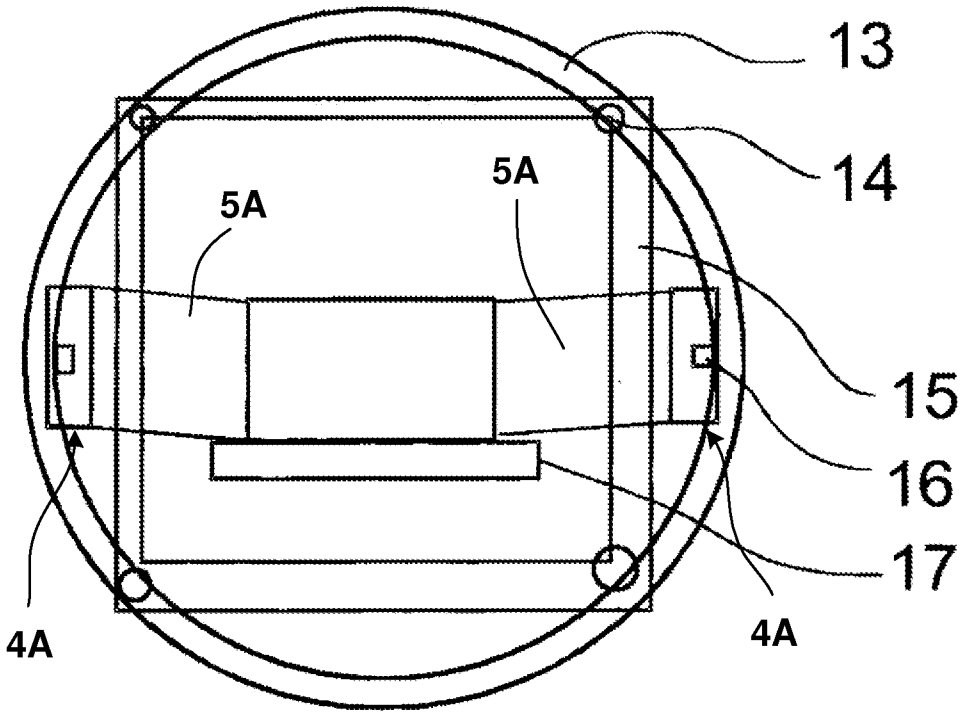


FIG. 8

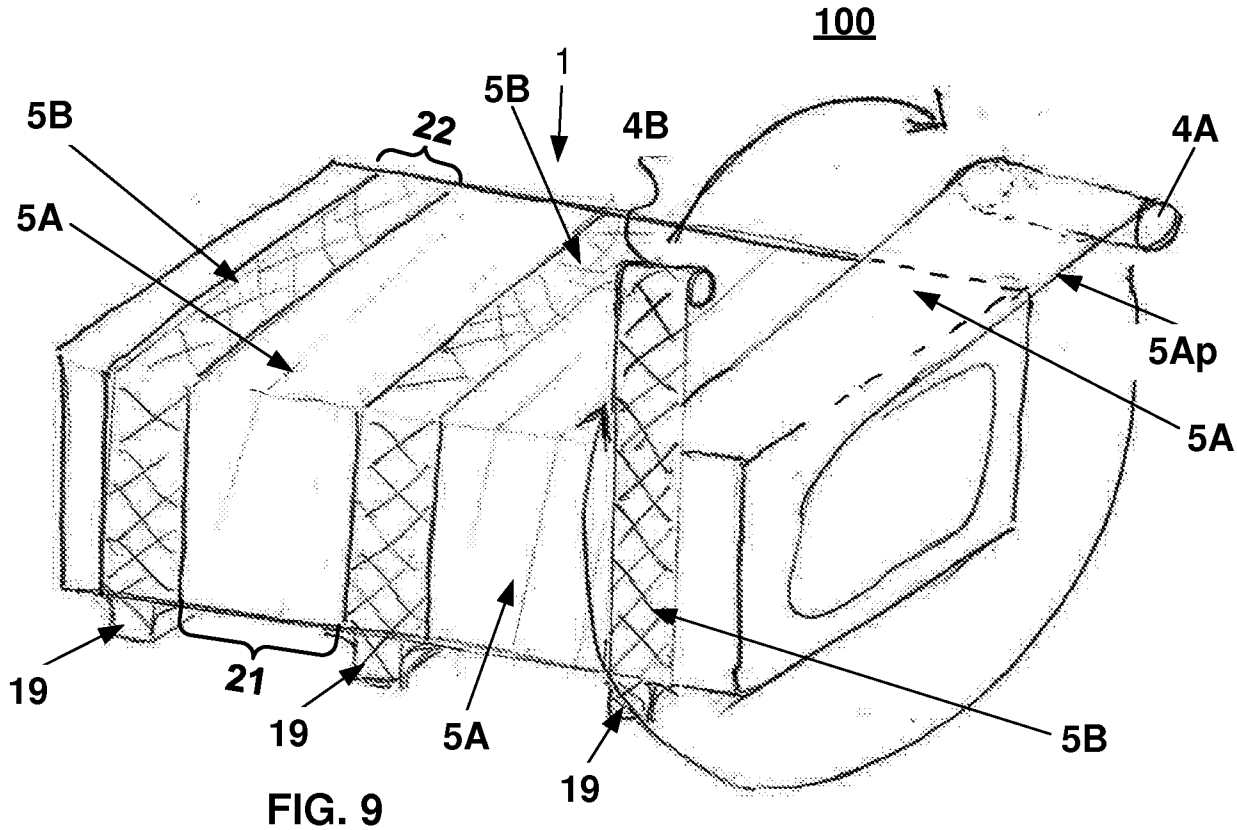

100
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22
4B
4A
5A
5Ap
5A
19
21
19
5A
19
5B

FIG. 9

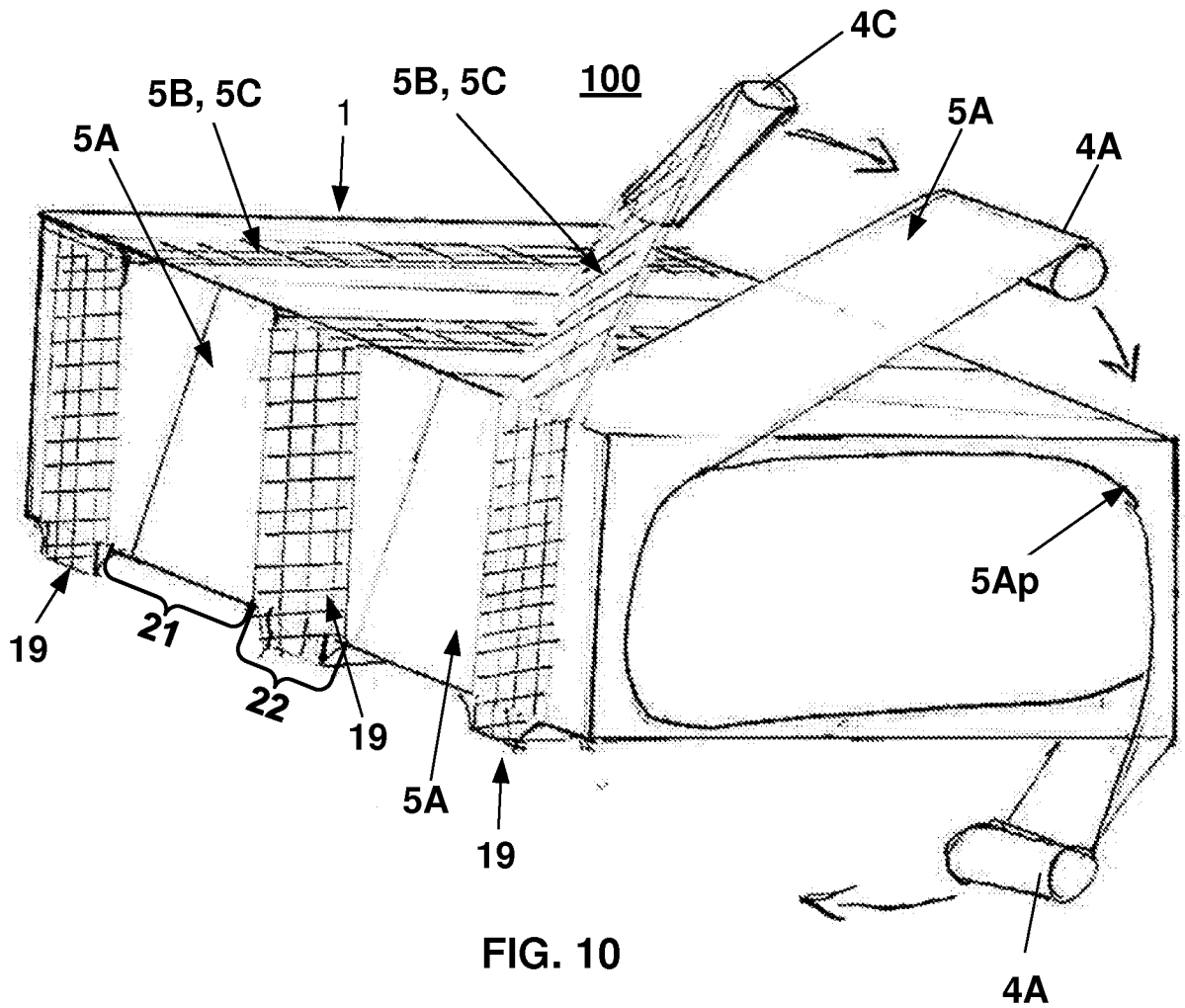

4C
5B, 5C
5B, 5C
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5A
5A
4A
5Ap
19
21
22
19
5A
19
4A

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2017/050231

A. **CLASSIFICATION OF SUBJECT MATTER**

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B65B, A01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base, and, where practicable, search terms used)

EPO-Internal full-text databases, Full-text translation databases from Asian languages, WPIAP

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A X Y	WO 2011051572 A1 (CROSS WRAP OY [FI]) 05 May 2011 (05.05.2011) claims 1, 9, 14-16; figures 1 and 7	1-12 13, 19-25 14-18, 26
Y	EP 1142787 A2 (MATSUMOTO SYSTEM ENGINEERING CO. LTD. [JP]) 10 October 2001 (10.10.2001) paragraphs [0007], [0042]; claim 1; figure 15	17, 18, 26
Y	EP 2835314 A1 (ONTEX BVBA [BE]) 11 February 2015 (11.02.2015) paragraph [0012], claims 1-5, figures 1-2	14-16

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 June 2017 (28.06.2017)	03 July 2017 (03.07.2017)

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2017/050231

CLASSIFICATION OF SUBJECT MATTER

IPC
B65B 11/58 (2006.01)
B65B 11/06 (2006.01)
B65B 27/12 (2006.01)
A01F 15/07 (2006.01)

INTERNATIONAL SEARCH REPORT
Information on Patent Family Members

International application No.
PCT/FI2017/050231

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