(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 837 588 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
07.09.2016 Bulletin 2016/36

(51) Int Cl.:
B65H 23/032 *(2006.01)* ***B65H 18/14*** *(2006.01)*

(21) Application number: **14169836.5**

(22) Date of filing: **26.05.2014**

(54) **Apparatus and method for rolling a carpet or a rug**

Vorrichtung und Verfahren zum Rollen eines Teppichs oder Läufers

Appareil et procédé pour enrouler une moquette ou un tapis

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

(30) Priority: **16.08.2013 DK 201370448**

(43) Date of publication of application:
18.02.2015 Bulletin 2015/08

(73) Proprietor: **Inwatec ApS**
5250 Odense SV (DK)

(72) Inventor: **Andresen, Mads**
5250 Odense SV (DK)

(74) Representative: **Nielsen, Leif**
Patrade A/S
Fredens Torv 3A
8000 Aarhus C (DK)

(56) References cited:
US-A- 3 556 425 **US-A- 4 256 269**
US-A- 4 420 124

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 2 837 588 B1

Description

Field of the invention

[0001] The present invention relates to an apparatus for rolling a carpet, a rug or a door mat, e.g. a cut pile door mat, where the apparatus at least comprises:

- an inlet conveyor and a roller mechanism, where the inlet conveyor is configured.to transport the mat from a feeding end of the inlet conveyor to an unloading end of the inlet conveyor arranged relative to the roller mechanism, wherein the inlet conveyor is coupled to a drive unit configured to drive the inlet conveyor,
- where the roller mechanism is configured to receive the mat from the inlet conveyor and to roll the mat into a compact configuration, wherein the mat comprises a top surface in which a plurality of piles are arranged.

[0002] The present invention also relates to a method for rolling a carpet, a rug, or a door mat, e.g. a cut pile door mat, using an apparatus as described above, where the method comprises the steps of:

- feeding the mat onto an inlet conveyor;
- transporting the mat to a roller mechanism via the inlet conveyor;
- rolling the mat into a compact configuration via the roller mechanism.

Background of the invention

[0003] Today, carpet rollers or mat rollers are often used to automatically roll carpets, mats, and rugs into a compact configuration for easy storage and handling. Such rollers may also be used in industrial laundries to roll blankets, duvets, towels and the like into a compact configuration. The mat or carpet is transferred to the carpet or mat roller typically after the cleaning and drying process where the roller mechanism rolls it into a compact configuration. This is typically done by placing the mat or carpet on a conveyor system which then is fed into the roller mechanism. The rolled up mat or carpet is then transferred onto an unloading station or another conveyor system and finally transferred to a storage unit for storage.

[0004] Today, the mats are typically fed into the roller mechanism by using a single inlet conveyor having a single conveyor belt extending beyond the width or length of the mat. The mat is normally placed on the conveyor in the same perpendicular direction relative to the roller mechanism regardless of the pile direction of the mat. During the rolling process, rotating roller elements roll the mat into a compact spiral shaped configuration where the top surface is brought into contact with the bottom surface. However, the direction of the piles in the mats may differ from the rolling direction causing the mat to shift and move sideways during the rolling process. This causes the mat to form a crooked compact configuration where the edges are not aligned in the same perpendicular plane relative to the longitudinal direction of the rolled up mat, but are instead biased towards the mat or away from the mat. This may require that the mat has to be unrolled and rolled up again which increases the handling of the mat. This also makes the edges more susceptible to damage during handling and storage and increases the risk that the edges form a bend or fold when the mat is unrolled.

[0005] US4256269, US4542859 and WO90/09946 describe examples of the known technology within the technical field.

[0006] Thus, there is room for improvement of such apparatuses as described above and there is a call for development of a new and improved apparatus and method which is simple, effective and easy to install and to operate.

Object of the invention

[0007] It is an object of the invention to provide an apparatus that is able to sense the pile direction of the mats.

[0008] Another object of the invention is to provide an apparatus that is able to adjust the direction of the mat relative to the pile direction so that the edges are aligned in the same plane during the rolling process.

[0009] A further object of the invention is to provide a method for rolling up a mat that allows the edges of the mat to be aligned during the rolling process in a simple manner.

Description of the invention

[0010] As mentioned above, the invention relates to an apparatus for rolling a carpet, a rug, or a door mat, characterised in that:

- the apparatus comprises at least one sensing unit for sensing a direction of the piles, wherein the sensing unit is coupled to a control unit configured to determine the pile direction of the mat.

[0011] This provides a roller unit that allows the mat to be positioned relative to the roller mechanism according to the pile direction before being fed into the roller mechanism. This allows the mat to be rolled into a compact configuration where the edges are aligned in the same plane. The term "mat" is defined as any type of a flat, rollable piece, such as door or floor mats, rugs, or carpets, having a top surface or nap comprising a plurality of piles or forming a pile structure. The piles may be loop piles, uncut or cut piles, tufted piles, or another type of pile. The "direction of the piles" or the "pile direction" is to be understood as terms indicating the impact of the mats tendency to become rolled into a crooked configuration

as mentioned above. It is therefore not necessarily the specific direction of the piles that are referred to but more generally the behaviour of the mat due to the pile direction when rolled. By detecting or sensing the direction of the piles, the mat can be arranged/rearranged in a suitable manner prior to being rolled in order to form a uniform rolled mat.

[0012] The mats may be placed on the inlet conveyor with the top or bottom surface facing the inlet conveyor manually or in a more automated manner. The sensing unit may be positioned above or below the inlet conveyor depending on the orientation of the mats. By placing the mat with the top surface facing away from the inlet conveyor allows for a quality check of the mat at the start of the process. The inlet conveyor may form part of the roller unit or part of a conveyor system coupled to the roller unit. By rolling the mat with the top surface facing outwards allows the mat in a flat configuration to form a better contact with the surface of the floor.

[0013] In an embodiment of the invention, the control unit may be coupled to a display unit for displaying the pile direction of the mat to an operator located at the roller unit. This allows the operator to manually adjust the position of the mat relative to the pile direction when placing the mat on the inlet conveyor. The pile direction may be used to determine the angle at which the mat is positioned relative to the roller mechanism. By placing the mat in an angled position relative to the roller mechanism, the shift and sideways movement of the mat due to the piles are counteracted.

[0014] In one embodiment, the apparatus comprises at least a second inlet conveyor arranged relative to the first conveyor in the same plane for feeding the mat into the roller mechanism, wherein the second inlet conveyor is configured to be driven at a speed that differs from the speed or is the same as the speed (V_1), at which the first inlet conveyor is driven, wherein the speed of at least one of the inlet conveyors is determined based on the pile direction.

Such a second inlet conveyor can advantageously be arranged in parallel with the first inlet conveyor as will be seen in fig. 4 and 5.

[0015] The apparatus may comprise two, three, four, five or more inlet conveyors arranged relative to each other in the same plane. The inlet conveyors may be placed side-by-side and may be spaced apart so that the sensing unit may be positioned in or over the gap formed between two inlet conveyors. The inlet conveyors may be coupled to the same drive unit via individual gear systems or coupled to their own drive unit where the control unit may control each drive unit and/or gear system. The drive unit(s) may be an electrical drive unit, such as an electrical motor, or a pneumatic or hydraulic drive unit. The inlet conveyors may comprise a conveyor belt or an endless chain on which the mat may be placed where at least one drive wheel drives the belt or chain. The inlet conveyors together form a common feeding end at which the mat may be fed into the apparatus. The inlet conveyors may be configured to be driven at the same speed or at different speeds determined according to the pile direction. This allows the position of the mat to be adjusted automatically by regulating/adjusting the speed of one or more of the inlet conveyors.

[0016] In one embodiment, the sensing unit at least comprises a moveable element configured to be brought into contact with the top surface of the mat, wherein the element is configured to be activated and moved by the piles.

[0017] The moveable element may be an elongated element having a free end shaped to contact and slide along the top surface, as the mat is moved past the sensing unit. The element may at the other end be coupled to a rotation point or axle allowing the element to rotate or pivot relative to that rotation point or axle. The element may be a free hanging element, such as a spherical, elliptical or another three-dimensional shaped element, suspended from a wire, string, or rope. The element may be configured to move freely relative to the mat in two or more directions or limited to move in one or two directions relative to the mat, e.g. perpendicular and/or parallel to the transport direction of the inlet conveyors. The movement of the element may be defined by the direction of the piles. This allows the pile direction to be sensed mechanically in a simple manner.

[0018] In a special embodiment, the sensing unit further comprises at least one sensor arranged relative to the moveable element, wherein the sensor is configured to sense the movement of the element.

[0019] The moveable element may be coupled to an electrical or optical sensor for transforming the mechanical movement into an electrical signal. The sensor may be a position/distance sensor or encoder configured to measure the angular or linear movement of the element. The sensor may be an electrical sensor configured to measure the movement as a change in the resistance, current or voltage of the sensor. The sensor may be an optical sensor or receiver configured to measure a reflected signal of the moveable element. An energy source or transmitter may be used to transmit a signal or beam, e.g. an IR-light beam or a laser beam, onto the element which is then picked up by the optical sensor or receiver. Any other type of sensor may be used to sense the movement of the element. The sensor may be positioned over the element and face the top surface of the mat, or it may be placed in the same plane as the element facing one of the sides of the element. A second sensor may be located at the other side and face that side. This allows the control unit to determine the pile direction based on the sensed data and adjust the speeds of the inlet conveyors accordingly.

[0020] In one embodiment, the sensing unit comprises at least an image capturing device, where the image capturing device is coupled to an image analysis module in the control unit for determining the pile direction based on the captured image data.

[0021] A camera or image scanner may be used to

determine the pile direction of the mat. The camera may be positioned at a distance from the inlet conveyor and face the top surface of the mat. A light source may be used to enhance the contours of the mat/piles and/or to increase the amount of reflected light. The pile direction is determined based on the captured image data. The type of camera is selected so that it has a pixel resolution and/or colour resolution that allows it to recognise the piles in the image data. This allows the pile direction to be determined wirelessly. The camera or one or more image sensors may alternatively be used to capture the movement of the moveable element.

[0022] In one embodiment, the roller mechanism at least comprises two sets of rotatable roller elements arranged relative to each other for rolling the mat into a compact configuration, where the two sets of roller elements are driven by at least one second drive unit and configured to rotate in the same direction.

[0023] The roller mechanism may comprise three, four, five, or more sets of roller elements which are arranged relative to each other, e.g. according to an arc or elliptical segment. Each set may comprise one or more roller elements distributed along a rotating axle for better guidance of the mat during the rolling process. The sets may form an opening through which the mat is transferred from the unloading end of the inlet conveyor and into the roller mechanism. The roller elements may be a wheel, e.g. of rubber or covered with a layer of rubber, or a disk shaped arrangement of radial extending brushes. Each set of roller elements may be driven by the same drive unit or individual drive units, such as an electrical drive unit in the form of a motor with an optional gear system. This provides a simple and compact roller mechanism that allows the size of the roller unit to be reduced. This also allows a damaged set of roller elements to be easily and quickly replaced.

[0024] The opening of the roller mechanism may be positioned adjacent to the unloading end of inlet conveyors in an inverted C-shaped configuration. This allows the mat to be transferred directly into the roller mechanism. The inlet conveyors may be placed in an angle position where the unloading end is located above the opening of the roller mechanism. The roller mechanism may be placed in a substantially U-shaped configuration. This allows the mat to be more or less dropped into the roller mechanism, and reduces the total length of the roller unit or allows the length of the inlet conveyor to be increased while maintaining the total length of the roller unit. At least one of the sets of roller elements may be configured to be moved, e.g. lowered, relative to other sets for unloading the rolled up mat onto an unloading station or another conveyor system.

[0025] In one embodiment, the roller mechanism at least comprises one roller conveyor or two roller conveyors arranged relative to the inlet conveyor for rolling the mat into a compact configuration, wherein the roller conveyor or the roller conveyors are configured to transport the mat in at least a second direction relative to the first direction of the inlet conveyor.

[0026] One or two of the sets of roller elements may be replaced with a roller conveyor arranged relative to the other two sets of roller elements. The roller conveyor may be configured to transport the mat from the inlet conveyor towards the roller elements. The roller conveyor may comprise a conveyor belt or an endless chain on which the mat may be placed where at least one drive wheel drives the belt or chain. The roller conveyor may be coupled to a pivot point located at the opposite end of the sets of roller elements where the roller conveyor may be pivoted relative to that pivot point for unloading the mat. The roller conveyor or the sets of roller elements may be configured to be raised or lowered relative to the sets of roller elements or roller conveyor for unloading the mat. This allows the mat to be rolled up using a combination of conveyors and rotating roller elements.

[0027] In a further embodiment of the invention, all sets of roller elements may be replaced by roller conveyors. In this embodiment, two, three, or more roller conveyors may be positioned relative to each other according to arc, elliptical or rectangular segment. The rolled up mat may be unloaded by pivoting the roller conveyor, as described above. This allows the mat to be rolled up using an arrangement of roller conveyors.

[0028] In one embodiment, the roller mechanism further comprises one or more guiding means, e.g. a guiding plate or rod, for guiding the mat into the compact configuration, where the guiding means are arranged relative to the sets of roller elements or the roller conveyors.

[0029] One or more of the sets of roller elements and/or roller conveyors may be omitted and replaced by one or more guiding means. The guiding means may be a plate or rod having a curved or straight shape configured to guide the mat into the desired direction. The plates or rods may be positioned so that they extend outwards from the surface of the roller elements or roller conveyor. This allows the number of moving parts in the roller mechanism to be reduced.

[0030] As mentioned above, the invention relates to a method for rolling a carpet, a rug, or a door mat, characterised in that:

- the direction of a plurality of piles arranged in a top surface of the mat is determined before the mat is transferred to the roller mechanism; and
- the placing of the mat is effected in an angled position relative to the roller mechanism, wherein the angled position is determined based on the pile direction.

[0031] This allows the mat to be positioned relative to the roller mechanism according to the pile direction (or according to a value dependent on the pile direction) before it is transferred into the roller mechanism. This counteracts the shift or sideways movement of the mat so that the edges of the mat are aligned in the same plane during the rolling process. A sensing unit facing the top surface of the mat may sense the pile direction which may be

displayed on a display located in the roller unit. An operator may then manually adjust the position of the mat according to the displayed pile direction, or according to an indicator dependent on the sensed pile direction, so that the mat is placed in an angled position more or less corresponding to the pile direction.

[0032] If the pile direction, or a value indicating the pile direction, is within a certain narrow threshold value, it can mean that the longitudinal direction of the mat, and thus the direction in which the mat is fed into the roller mechanism, is ok and the position of the mat may not be adjusted. If the pile direction, or a value indicating the pile direction, is above or below a certain threshold value, the mat may be placed in an angled position, positive or negative, relative to the longitudinal direction. Then the mat may be turned, clockwise or anticlockwise, by an amount equal to the sensed value so that the longitudinal direction of the mat is corrected to be substantially nonparallel with the inlet conveyor.

[0033] In one embodiment, the mat is fed onto at least two inlet conveyors where the speed of at least one of the inlet conveyors is determined according to the pile direction. Said two inlet conveyors can be arranged in parallel and side by side in the same plane.

[0034] This allows the adjustment of the mat to be carried out in an automatic manner where the speed of one or more inlet conveyors is regulated to turn or angle the mat relative to the roller mechanism. The change in the speed for each inlet conveyor may be determined as function of the pile direction and optionally the number of the inlet conveyors. One of the inlet conveyors, e.g. the rightmost or leftmost, may be used as reference where the speeds of the other inlet conveyors are increased or decreased by a predetermined amount. Additionally or alternatively, the inlet conveyors may be divided into two groups where the speed of one group, e. g. the left half, is increased and the speed of the other group, e.g. the right half, is reduced, or vice versa. This allows the control unit to determine the pile direction and then adjust the speed of the inlet conveyors for placing the mat in a proper angular position relative to the roller mechanism.

[0035] In one embodiment, at least one sensing unit senses the pile direction by directly contacting the top surface of the mat and/or by wirelessly sensing, and a control unit determines the pile direction based on the sensed data.

[0036] The pile direction may be sensed mechanically by using a moveable element contacting the top surface as the mat passes by. One or more sensors coupled directly to the element or arranged in the same plane relative to the element may sense the movement of the element and transforms the movement into an electrical signal for the control unit. This provides a simple and easy way of detecting the pile direction of the mat.

[0037] The pile direction may additionally or alternatively be sensed by using a camera or an image scanner where the captured image data is analysed in the control unit by an image analysis unit. This unit determines the pile direction based on the image data and transmits it to the control unit. This may be done by extracting one or more parameters from the image data and then compare these parameters to one or more sets of reference parameters or patterns. The data are then evaluated in order to determine the direction of the piles. This allows the pile direction to be determined wirelessly, i.e. without contacting the mat.

[0038] In one embodiment, the mat is rolled into the compact configuration by passing the mat by at least two sets of roller elements and/or one or more roller conveyors.

[0039] The roller mechanism may comprise at least three or four sets of roller elements rotating in the same direction where the sets form an open inner area configured to receive the mat. Each set guides the mat into a new direction so that the mat is rolled into a spiral shaped compact configuration where the top surface contacts with the bottom surface, or vice versa. This provides a simple and compact way of rolling the mats. The mat may be transferred onto two or more roller conveyors arranged to form an inner open area configured to receive the mat. Each roller conveyor may transport or guide the mat into a new direction so that the mat is rolled into the compact configuration. This provides another way of rolling the mat. One or more guiding means may be used together with the set of roller elements and/or roller conveyor to guide the mat into the compact configuration. This allows the mat to be rolled up by using a reduced number of moveable parts.

[0040] In an embodiment of the invention, the roller unit may comprise two or more inlet conveyors coupled to the same drive unit or individual drive units where the control unit controls each drive unit. The control unit may be configured to adjust the speed of one or both inlet conveyors based on a control signal indicating the pile direction of a passing mat. The control unit may receive the control signal from an external sensing unit located at an earlier stage in the process line. The pile direction may be displayed to the operator which is able via a user interface, e.g. a touch-sensitive screen or a rotatable knob, to adjust the pile direction, or even input the desired pile direction.

Description of the drawing

[0041] An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

- Fig. 1 shows an exemplary embodiment of a mat with piles in a flat configuration;
- Fig. 2 shows the mat of fig. 1 in a compact configuration after a conventional rolling process;
- Fig. 3 shows the mat of fig. 2 seen from the side;
- Fig. 4 shows an exemplary embodiment of a roller unit according to the invention;

Fig. 5 shows a mat placed in the roller unit of fig. 4;
Fig. 6 shows a side view of a first embodiment of the roller unit;
Fig. 7 shows a side view of a second embodiment of the roller unit; and
Fig. 8 shows a side view of a third embodiment of the roller unit.

[0042] In the following text, the figures,will be described one by one, and the different parts and positions seen in the figures will be numbered with the same numbers in the different figures. Not all parts and positions indicated in a specific figure will necessarily be discussed together with that figure.

Position number list

[0043]

1	Mat
2	Base element
3	Bottom surface
4	Piles
5	Top surface
6	Pile direction
7	Edges of mat
8	Plane
9	Mat roller
10	First inlet conveyor
11	Second inlet conveyor
12	Roller mechanism
13	Feeding end
14	Unloading end
15	Sensing unit
16	Upper surface of inlet conveyors
17	Moveable element
18	Rotation point
19	Angular movement
20	Longitudinal direction, feeding direction
21	Roller element
22	Rotation direction
23	Opening
24	Roller conveyor
25	First transport direction
26	Second roller conveyor
27	Second transport direction
28	Guiding means
V_1	First speed
V_2	Second speed

Detailed description of an embodiment according to the invention

[0044] Fig. 1 shows an exemplary embodiment of a mat 1 in flat configuration. The mat 1 may comprise a base element 2 having a bottom surface 3 configured to lie against a floor in a building or a transport unit. A plurality of piles 4 may be coupled to or form part of the base element 2. The piles 4 form a top surface 5 of the mat 1. The piles 4 may be arranged in a predetermined direction (indicated by arrow) 6 relative to the base element 2.

[0045] Fig. 2 shows the mat 1 in a compact configuration after a conventional rolling process. The pile direction 6 of the piles 4 may cause the mat 1 to move sideways in the same direction as the piles 4. This causes the edges 7 of the mat 1 to be misaligned so that they are biased out of the vertical plane 8 defined by the edges of the innermost loop of the compact configuration.

[0046] Fig. 3 shows the mat 1 in the compact configuration seen from one end. In the compact configuration the mat 1 may be orientated with the top surface 5 facing outwards. During the rolling process, the bottom surface 3 may be brought into contact with the top surface 5.

[0047] Fig. 4 shows an exemplary embodiment of a roller unit 9 according to the invention. The roller unit 9 may be configured as a mat roller comprising two inlets conveyors 10, 11 and a roller mechanism 12 arranged relative to the inlet conveyors 10, 11. The roller mechanism 12 is omitted from fig. 4, as the roller unit 9 is seen from the top. The two inlet conveyors 10, 11 may be arranged side-by-side and spaced apart so that a gap may be formed between the two inlet conveyors 10, 11, as shown in fig. 4. The inlet conveyors 10, 11 may form a common feeding end 13 and a common unloading end 14. The mats 1 may be fed or loaded onto the roller unit 9 at the feeding end 13. The mats 1 may be transferred from the inlet conveyors 10, 11 to the roller mechanism 12 at the unloading end 14, as shown in figs. 6-7.

[0048] The inlet conveyors 10, 11 may be coupled to individual drive units (not shown) which may be controlled by a control unit (not shown). The first inlet conveyor 10 may be driven at a first speed V_1 and the second inlet conveyor 11 may be driven at a second speed V_2. Until the control unit has determined the pile direction 6, the first and second speeds V_1, V_2 may be the same.

[0049] A sensing unit 15 may be arranged relative to an upper surface 16 of the inlet conveyors 10, 11. The sensing unit 15 may comprise a moveable element 17 configured to be brought into contact with the mat 1, as it passes the sensing unit 15. The element 17 may comprise a free end shaped to be brought into with and slide along the top surface 5 of the mat 1. The element 17 may at the other end be coupled to a rotation point 18 so that the element 17 is able to rotate relative to the rotation point 18. A sensor (not shown) may be coupled to the element 17 for measuring the angular movement (marked with arrow 19 in fig. 5) of the element 17.

[0050] Fig. 5 shows a mat 1 placed in the roller unit 9 where the mat 1 may be moved towards the roller mechanism 12 in a feeding direction (marked with arrow 20). This direction also indicated the longitudinal direction of the mat 1. The piles 4 may cause the element 17 to move more or less into the same direction 6 as the piles 4, as shown in fig. 5. The angular movement 19 may then be measured by the sensor and transmitted to the control unit. The control unit may then determine the pile direc-

tion 6 based on the data from the sensor.

[0051] The control unit may then transmit a control signal to the drive unit of the first inlet conveyor 10 for decreasing the first speed V_1 or transmit a control signal to the drive unit of the second inlet conveyor 11 for increasing the second speed V_2. The change in speed may cause the mat 1 to turn relative to the initial direction 20, thereby placing the mat 1 in an angled position relative to the roller mechanism 12 where the mat 1 is substantially placed in the same direction as the sensed pile direction 6.

[0052] Fig. 6 shows a side view of a first embodiment of the roller unit 9 where the inlet conveyors 10, 11 may be placed in angled/inclined position, as shown in the figure. The roller mechanism 12 may comprise four or more sets of roller elements 21 configured to rotate in the same direction (marked with arrow 22). The sets of roller elements 21 may be arranged so that they form a substantially U-shaped configuration with an opening 23 for receiving the mat 1. The unloading end 14 may be located above the opening 23 so that the mat 1 more or less is dropped into the roller mechanism 12. The roller elements 21 may be an arrangement of brushes coupled to a rotating axle.

[0053] The rightmost set of roller element 21d may be configured to be raised and lowered relative to other sets of roller elements 21a-c for transferring the rolled up mat 1 to an unloading station or another conveyor system (not shown).

[0054] Fig. 7 shows a side view of a second embodiment of the roller unit 9' where two of the sets of roller elements 21c-d are omitted and replaced by a roller conveyor 24. The roller conveyor 24 may be positioned below the unloading end 14 so that the mat 1 is more or less dropped onto the roller conveyor 24. The roller conveyor 24 may then transport (marked with arrow 25) the mat 1 to the two sets of roller elements 21 a-b which together with the roller conveyor 24 may roll up the mat 1.

[0055] The roller conveyor 24 may be configured to be raised and lowered relative to the sets of roller elements 21a-b for transferring the rolled up mat 1 to the unloading station or the conveyor system (not shown).

[0056] Fig. 8 shows a side view of a third embodiment of the roller unit 9" where the sets of roller elements 21 are omitted and a second roller conveyor 26 is arranged relative to the first roller conveyor 24. The second roller conveyor 26 may be placed in an angled position, e.g. perpendicularly, relative to the first roller conveyor 24 and may be configured to transport (marked with arrow 27) towards one or more guiding means 28. The guiding means 28 may be arranged relative to the second roller conveyor 26 and may be shaped to guide the mat 1 back onto it self so that the top and bottom surfaces 3, 5 are brought into contact with each other.

[0057] The first roller conveyor 24 may be configured to pivot around a pivot point located at the opposite end of the second conveyor 26 for transferring the rolled up mat 1 to the unloading station or the conveyor system (not shown).

[0058] The inlet conveyors 10, 11 may be arranged relative to the first roller conveyor 24 so that the unloading end 14 is placed adjacent to the pivot point. Alternatively, the first roller conveyor 24 may be omitted and the inlet conveyors 10, 11 may then act as the first roller conveyor 24, as shown in fig. 8.

[0059] The present invention is not limited to the described embodiments. The described embodiments may be combined and modified within the skills of a person skilled in the art, and within the scope as defined in the appended claims.

Claims

1. An apparatus for rolling a carpet, a rug or a door mat, e.g. a cut pile door mat (1), where the apparatus (9) at least comprises:

   - an inlet conveyor (10) and a roller mechanism (12), where the inlet conveyor (10) is configured to transport the mat (1) from a feeding end (13) of the inlet conveyor (10) to an unloading end (14) of the inlet conveyor (10) arranged relative to the roller mechanism (12), wherein the inlet conveyor (10) is coupled to a drive unit configured to drive the inlet conveyor (10),
   - where the roller mechanism (12) is configured to receive the mat (1) from the inlet conveyor (10) and to roll the mat (1) into a compact configuration, wherein the mat (1) comprises a top surface (5) in which a plurality of piles (4) are arranged, **characterised in, that**
   - the apparatus comprises at least one sensing unit (15) for sensing a direction (6) of the piles (4), wherein the sensing unit (15) is coupled to a control unit configured to determine the pile direction (6) of the mat (1).

2. An apparatus according to claim 1, **characterised in that** the apparatus comprises at least a second inlet conveyor (11) arranged relative to the first conveyor (10) in the same plane for feeding the mat (1) into the roller mechanism (12), wherein the second inlet conveyor (11) is configured to be driven at a speed (V_2) that differs from the speed (V_1) or is the same as the speed (V_1), at which the first inlet conveyor (10) is driven, wherein the speed (V_1, V_2) of at least one of the inlet conveyors (10, 11) is determined based on the pile direction (6).

3. An apparatus according to claim 1 or 2 **characterised in that** the sensing unit (15) at least comprises a moveable element (17) configured to be brought into contact with the top surface (5) of the mat (1), wherein the element (17) is configured to be activated and moved by the piles (4).

4. An apparatus according to claim 3 **characterised in that** the sensing unit (17) further comprises at least one sensor arranged relative to the moveable element (17), wherein the sensor is configured to sense the movement of the element (17).

5. An apparatus according to any one of claims 1 to 4 **characterised in that** the sensing unit (15) at least comprises an image capturing device, where the image capturing device is coupled to an image analysis module in the control unit for determining the pile direction (6) based on the captured image data.

6. An apparatus according to any one of claims 1 to 5 **characterised in that** the roller mechanism (12) at least comprises two sets of rotatable roller elements (21) arranged relative to each other for rolling the mat (1) into a compact configuration, where the two sets of roller elements (21) are driven by a least one second drive unit and configured to rotate in the same direction (22).

7. An apparatus according to any one of claims 1 to 6 **characterised in that** the roller mechanism (12) at least comprises one roller conveyor (24) or two roller conveyors (24, 26) arranged relative to the inlet conveyor (10, 11) for rolling the mat (1) into a compact configuration, wherein the roller conveyor (24) or the roller conveyors (24, 26) are configured to transport the mat (1) in at least a second direction (25, 27) relative to the direction (20) of the inlet conveyor (10, 11).

8. An apparatus according to claim 6 or 7 **characterised in that** the roller mechanism (12) further comprises one or more guiding means (28), e.g. a guiding plate or rod, for guiding the mat (1) into the compact configuration, where the guiding means (28) are arranged relative to the sets of roller elements (21) or the roller conveyors (24, 26).

9. A method for rolling a carpet, a rug or a door mat, e. g. a cut pile door mat (1), using an apparatus (9) according to any one of the preceding claims, where the method comprises the steps of:

- feeding a mat (1) onto an inlet conveyor (10);
- transporting the mat (1) to a roller mechanism (12) via the inlet conveyor (10);
- rolling the mat (1) into a compact configuration via the roller mechanism (12), **characterised in, that**
- the direction (6) of a plurality of piles (4) arranged in a top surface (5) of the mat (1) is determined before the mat (1) is transferred to the roller mechanism (12); and
- placing the mat (1) in an angled position relative to the roller mechanism (12), wherein the angled position is determined based on the pile direction (6).

10. A method according to claim 9 **characterised in that** the mat (1) is fed onto at least two inlet conveyors (10, 11), where the speed of at least one of the inlet conveyors (10, 11) is determined based on the pile direction (6).

11. A method according to claim 9 or 10 **characterised in that** at least one sensing unit (15) senses the pile direction (6) by directly contacting the top surface (5) and/or wirelessly, and a control unit determines the pile direction (6) based on the sensed data.

12. A method according to any one of claims 9 to 11 **characterised in that** the mat (1) is rolled into the compact configuration by passing the mat (1) by at least two sets of roller elements (21) and/or one or more roller conveyors (24, 26).

Patentansprüche

1. Vorrichtung zum Aufrollen eines Teppichs, eines Vorlegers oder einer Fußmatte, z.B. einer Schnittflor-Fußmatte (1), wobei die Vorrichtung (9) mindestens folgendes umfasst:

- ein Einlaufband (10) und einen Rollmechanismus (12), wobei das Einlaufband (10) zum Fördern der Matte (1) von einem Zufuhrende (13) des Einlaufbandes (10) bis zu einem Entladeende (14) des relativ zum Rollmechanismus (12) angeordneten Einlaufbandes (10) konfiguriert ist, wobei das Einlaufband (10) mit einer Antriebseinheit zum Treiben des Einlaufbandes (10) verbunden ist,
- wobei der Rollenmechanismus (12) zum Empfangen der Matte (1) von dem Einlaufband (10) und zum Aufrollen der Matte (1) zu einer kompakten Konfiguration konfiguriert ist, wobei die Matte (1) Oberfläche (5) umfasst, worin eine Vielfalt an Flor angeordnet ist,

dadurch gekennzeichnet, dass

- die Vorrichtung wenigstens eine Fühlereinheit (15) zum Erkennen einer Richtung (6) der Flor (4) aufweist, wobei die Fühlereinheit (15) mit einer zum Festlegen der Florrichtung (6) der Matte (1) konfigurierten Steuereinheit verbunden ist.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Vorrichtung mindestens ein zweites Einlaufband (11) umfasst, das relativ zu dem ersten Förderband (10) zum Einführen der Matte (1) in den Rollenmechanismus (12) in derselben Ebene

angeordnet ist, wobei das zweite Einlaufband (11) zum Treiben bei einer von der Geschwindigkeit (V_1), mit der das erste Eintragsförderband (10) getrieben wird, unterschiedlichen oder nicht unterschiedlichen Geschwindigkeit (V_2) konfiguriert ist, wobei sich das Festlegen der Geschwindigkeit (V_1, V_2) mindestens eines der Eintragsförderbänder (10, 11) auf der Florrichtung gründet.

3. Vorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Fühlereinheit (15) mindestens ein verschiebbares Element (17) umfasst, das für das Inkontaktbringen mit der Oberfläche (5) der Matte (1) konfiguriert ist, wobei das Element (17) für Betätigung und Verschiebung durch die Flor konfiguriert ist.

4. Vorrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** die Fühlereinheit (17) ferner mindestens einen relativ zum verschiebbaren Element (17) angeordneten Fühler umfasst, wobei der Fühler zum Erkennen der Verschiebung des Elements (17) konfiguriert ist.

5. Vorrichtung nach irgendeinem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Fühlereinheit (15) mindestens eine Bildaufnahmeeinrichtung umfasst, wobei die Bildaufnahmeeinrichtung mit einem Bildauswertungsmodul in der Steuereinrichtung zum Festlegen der Florrichtung (6) aufgrund der aufgenommenen Bilddaten verbunden ist.

6. Vorrichtung nach irgendeinem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** der Rollenmechanismus (12) mindestens zwei Sätze von rotierbaren Rollenelementen (21) umfasst, die relativ zueinander zum Aufrollen der Matte (1) zu einer kompakten Konfiguration angeordnet sind, wobei die zwei Sätze von Rollenelementen (21) von mindestens einer zweiten Treibeinheit getrieben werden und zur Rotation in derselben Richtung (22) konfiguriert sind.

7. Vorrichtung nach irgendeinem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** der Rollenmechanismus (12) mindestens ein Rollenförderband (24) oder zwei relativ zum Einlaufband angeordnete Rollenförderbänder (24, 26) zum Aufrollen der Matte (1) zu einer kompakten Konfiguration umfasst, wobei das Rollenförderband (24) oder die Rollenförderbänder (24, 26) zum Fördern der Matte (1) in mindestens einer zweiten Richtung (25, 27) relativ zur Richtung (20) des ersten Einlaufbandes (10, 11) konfiguriert ist/sind.

8. Vorrichtung nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** der Rollenmechanismus (12) ferner mindestens ein Steuerungsmittel (28) umfasst, z.B. eine Steuerplatte oder einen Steuerbalken, zum Steuern der Matte (1) in eine kompakte Konfiguration, wobei die Steuermittel (28) relativ zu den Sätzen von Rollenelementen (21) oder zu den Rollenförderbändern (24, 26) angeordnet sind.

9. Verfahren zum Aufrollen eines Teppichs, eines Vorlegers oder einer Fußmatte, z.B. einer Schnittflor-Fußmatte (1), mittels einer Vorrichtung (9) nach irgendeinem der vorhergehenden Ansprüche, wobei das Verfahren die folgenden Verfahrensschritte umfasst:

- Einführung der Matte (1) auf ein Einlaufband (10);
- Fördern der Matte (1) zu einem Rollenmechanismus (12) durch den Einlaufband (10),
- Aufrollen der Matte (1) zu einer kompakten Konfiguration durch den Rollenmechanismus (12),

dadurch gekennzeichnet, dass

- die Richtung (6) der auf der Oberfläche (5) der Matte (1) angeordneten Vielfalt an Flor (4) vor der Überführung der Matte (1) zum Rollenmechanismus (12) festgelegt wird; und
- die Matte (1) in einer Winkelstellung relativ zum Rollenmechanismus (12) gebracht wird, wobei sich das Festlegen der Winkelstellung auf der Florrichtung (6) gründet.

10. Verfahren nach Anspruch 9, **dadurch gekennzeichnet, dass** die Matte (1) mindestens zwei Einlaufbändern (10, 11) zugeführt wird, wobei sich das Festlegen der Geschwindigkeit mindestens eines der Einlaufbänder (10, 11) auf der Florrichtung (6) gründet.

11. Verfahren nach Anspruch 9 oder 10, **dadurch gekennzeichnet, dass** wenigstens eine Fühlereinheit (15) die Florrichtung (6) durch direkte Kontakt mit der Oberfläche (5) und/oder drahtlos erkennt, und die Florrichtung (6) wird, auf den erkannten Daten gegründet, von der Steuereinheit festgelegt.

12. Verfahren nach irgendeinem der Ansprüche 9 bis 11, **dadurch gekennzeichnet, dass** die Matte (1) durch Vorbeiführung der Matte von mindestens zwei Sätzen von Rollenelementen (21) und/oder mindestens einem Rollenförderband (24, 26), zu einer kompakten Konfiguration aufgerollt wird.

Revendications

1. Appareil pour enrouler une moquette, un tapis ou un paillasson, par exemple un paillasson à poils coupés

(1), l'appareil (9) comprend au moins :

- un transporteur d'entrée (10) et un mécanisme de rouleaux (12), le transporteur d'entrée (10) étant configuré pour transporter le paillasson (1) à partir d'une extrémité de chargement (13) du transporteur d'entrée (10) à une extrémité de déchargement (14) du transporteur d'entrée (10) aménagé par rapport au mécanisme de rouleaux (12), dans lequel le transporteur d'entrée (10) est couplé à une unité d'entraînement configurée pour entraîner le transporteur d'entrée (10),
- le mécanisme de rouleaux (12) étant configuré pour recevoir le paillason (1) venant du transporteur d'entrée (10) et enrouler le paillasson (1) en une configuration compacte, dans lequel le paillasson (1) comprend une surface supérieure (5) dans laquelle une pluralité de poils (4) sont disposés,

caractérisé en ce que

- l'appareil comprend au moins une unité de détection (15) pour détecter une direction (6) des poils (4), dans lequel l'unité de détection (15) est couplée à une unité de contrôle configurée pour déterminer la direction des poils (6) du paillasson (1).

2. Appareil selon la revendication 1, **caractérisé en ce que** l'appareil comprend au moins un deuxième transporteur d'entrée (11) aménagé par rapport au premier transporteur (10) au même niveau pour faire entrer le paillasson (1) dans le mécanisme de rouleaux (12), dans lequel le deuxième transporteur d'entrée (11) est configuré pour être entraîné à une vitesse (V_2) qui est différente de la vitesse (V_1) ou qui correspond à la vitesse (V_1) à laquelle le premier transporteur d'entrée (10) est entrainé, dans lequel la vitesse (V_1, V_2) d'au moins l'un des transporteurs d'entrée (10, 11) est déterminée par rapport à la direction des poils (6).

3. Appareil selon la revendication 1 ou 2, **caractérisé en ce que** l'unité de détection (15) comprend au moins un élément mobile (17) configuré pour être mis en contact avec la surface supérieure (5) du paillasson (1), dans lequel l'élément (17) est configuré pour être activé et déplacé par les poils (4).

4. Appareil selon la revendication 3, **caractérisé en ce que** l'unité de détection (17) comprend encore au moins un détecteur disposé par rapport à l'élément mobile (17), dans lequel le détecteur est configuré pour détecter le mouvement de l'élément (17).

5. Appareil selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** l'unité de détection (15) comprend au moins un dispositif de capture d'image, le dispositif de capture d'image est couplé à un module d'analyse d'image dans l'unité de contrôle pour déterminer la direction des poils (6) basée sur les données de l'image capturée.

6. Appareil selon l'une quelconque des revendications 1 à 5, **caratérisé en ce que** le mécanisme de rouleaux (12) comprend au moins deux ensembles d'éléments à rouleaux rotatifs (21) aménagés l'un par rapport à l'autre pour enrouler le paillasson (1) en une configuration compacte, les deux ensembles d'éléments à rouleaux rotatifs (21) sont entraînés par au moins une deuxième unité d'entraînement et configurés pour tourner dans la même direction (22).

7. Appareil selon l'une quelconque des revendications 1 à 6, **caratérisé en ce que** le mécanisme de rouleaux (12) comprend au moins un transporteur à rouleaux (24) ou deux transporteurs à rouleaux (24, 26) aménagés par rapport au transporteur d'entrée (10, 11) pour enrouler le paillasson (1) en une configuration compacte, dans lequel le transporteur à rouleaux (24) ou les transporteurs à rouleaux (24, 26) sont configurés pour transporter le paillasson (1) dans au moins une deuxième direction (25, 27) par rapport à la direction (20) du transporteur d'entrée (10, 11).

8. Appareil selon la revendication 6 ou 7, **caractérisé en ce que** le mécanisme de rouleaux (12) comprend encore un ou plusieurs moyens de guidage (28), par exemple une plaque de guidage ou une traverse de guidage, pour guider le paillasson (1) afin d'obtenir la configuration compacte, les moyens de guidage (28) sont aménagés par rapport aux ensembles d'éléments à rouleaux (21) ou les transporteurs à rouleaux (24, 26).

9. Procédé pour enrouler une moquette, un tapis ou un paillasson, par exemple un paillasson à poils coupés (1), en utilisant un appareil (9) selon l'une quelconque des revendications précédentes, le procédé comprenant les étapes de :

- introduire un paillasson (1) sur le transporteur d'entrée (10) ;
- transporter le paillasson (1) à un mécanisme de rouleaux (12) à l'aide du transporteur d'entrée (10) ;
- enrouler le paillasson (1) en une configuration compacte à l'aide d'un mécanisme de rouleaux (12) ;
- **caractérisé en ce que**
- la direction (6) d'une pluralité de poils (4) aménagés sur la surface supérieure (5) du paillasson (1) est déterminée avant le transfert du paillas-

son (1) au mécanisme de rouleaux (12) ; et
- placer le paillasson (1) dans une position angulaire par rapport au mécanisme de rouleaux (12), dans lequel la position angulaire est déterminée par rapport à la direction des poils (6).

10. Procédé selon la revendication 9, **caractérisé en ce que** le paillasson (1) est introduit sur au moins deux transporteurs d'entrée (10, 11), la vitesse d'au moins un des transporteurs d'entrée (10, 11) est déterminée par rapport à la direction des poils (6).

11. Procédé selon la revendication 9 ou 10, **caractérisé en ce qu**'au moins une unité de détection (15) détecte la direction des poils (6) en contactant directement la surface supérieure (5) et/ou sans fil, et une unité de contrôle détermine la direction des poils (6) basée sur les données détectées.

12. Procédé selon l'une quelconque des revendications 9 à 11 **caractérisé en ce que** le paillasson (1) est enroulé pour obtenir la configuration compacte en passant le paillasson (1) à travers au moins deux ensembles d'éléments à rouleaux (21) et/ou un ou plusieurs transporteurs à rouleaux (24, 26).

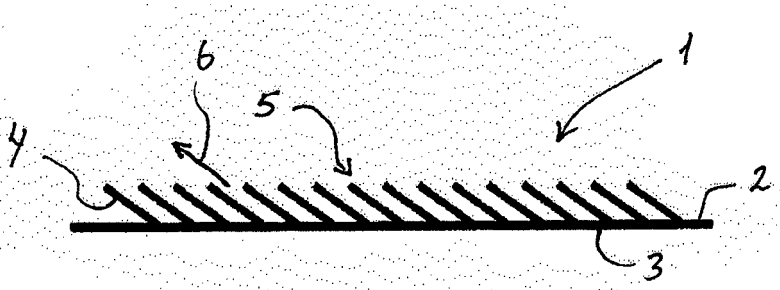


Fig. 1

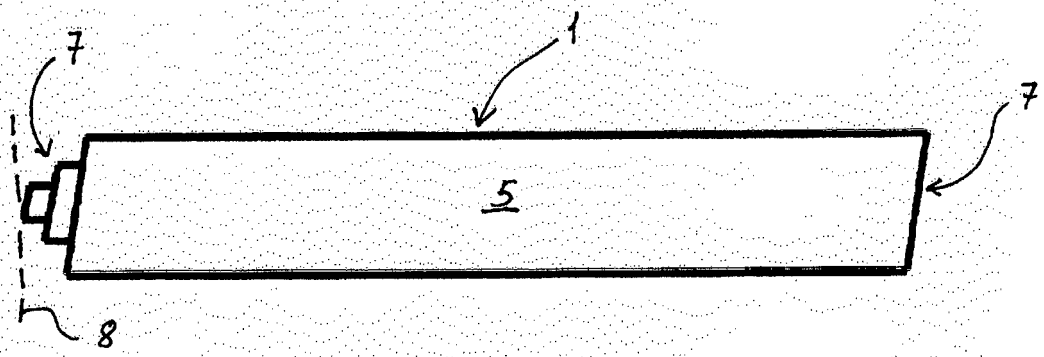


Fig. 2

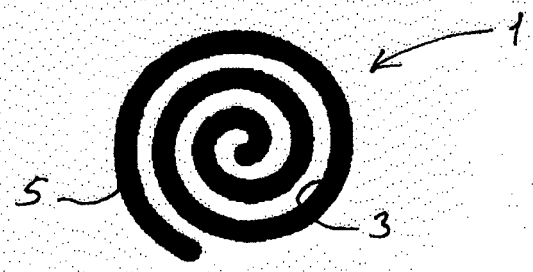


Fig. 3

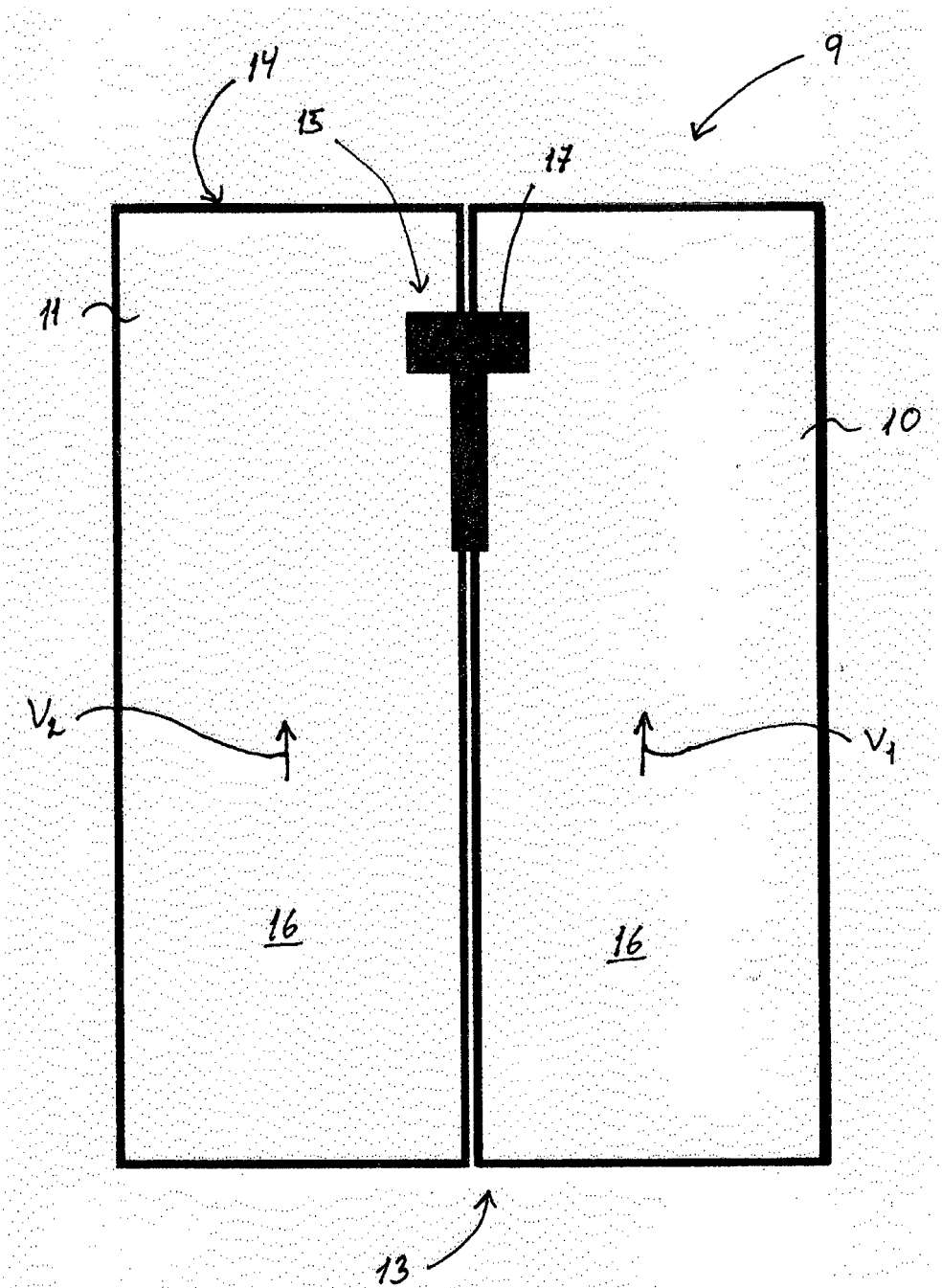


Fig. 4

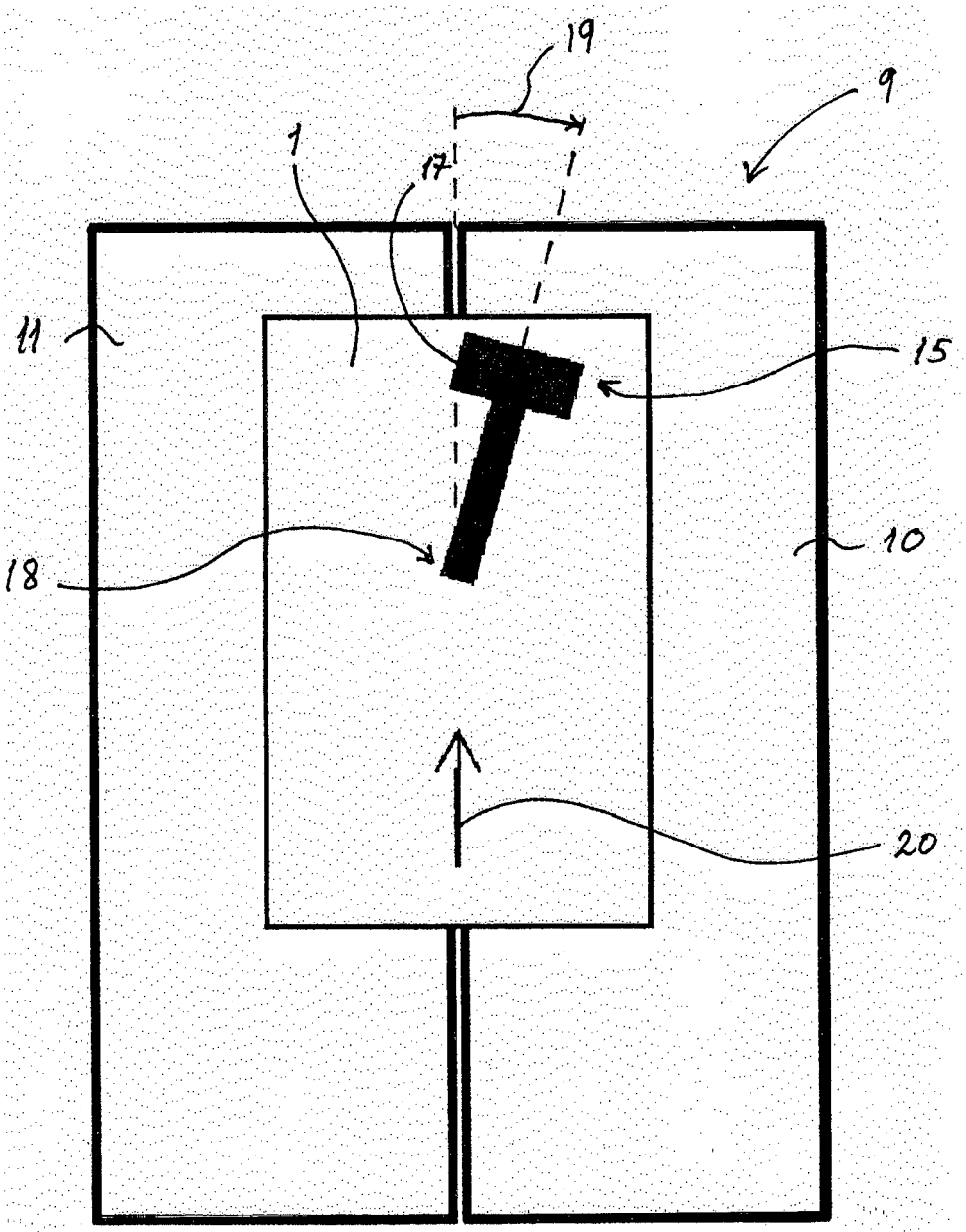


Fig. 5

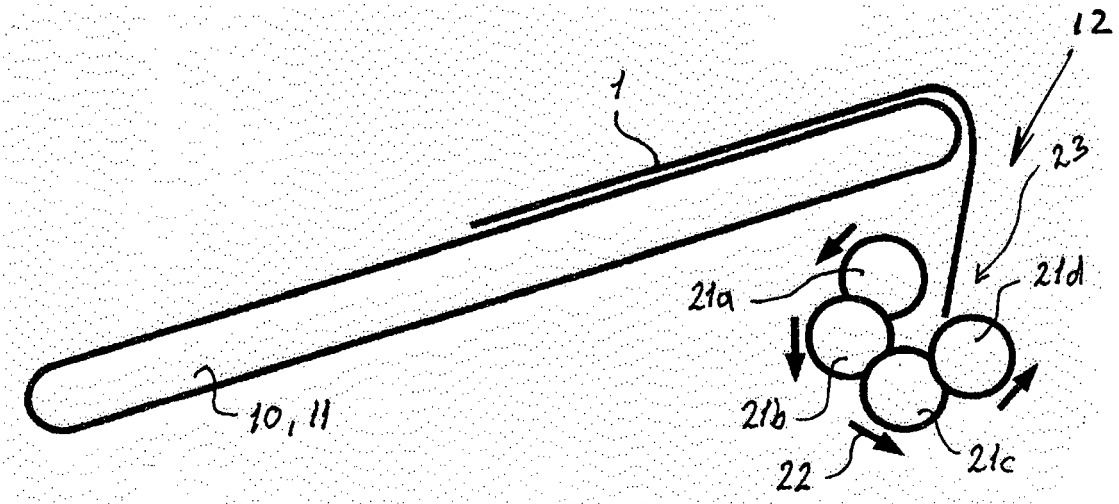


Fig. 6

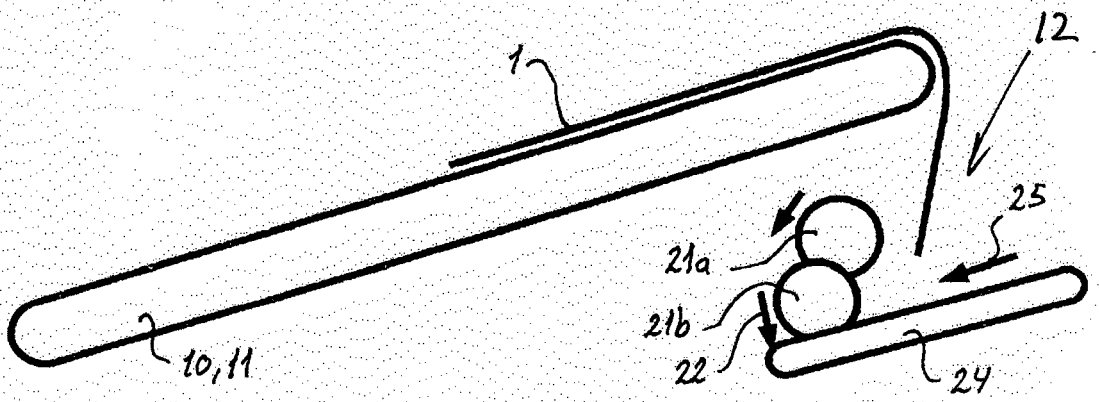


Fig. 7

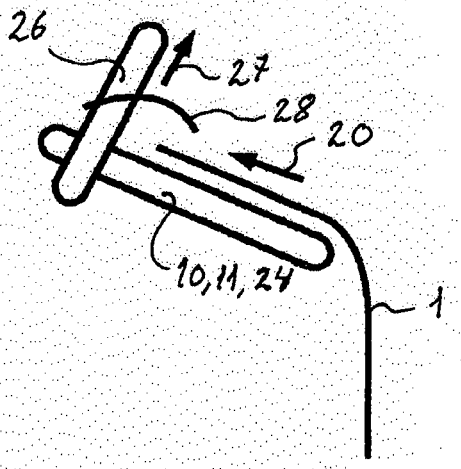


Fig. 8

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4256269 A **[0005]**
- US 4542859 A **[0005]**
- WO 9009946 A **[0005]**