



- (51) **International Patent Classification:**
B65H 18/22 (2006.01)
- (21) **International Application Number:**
PCT/EP2016/065949
- (22) **International Filing Date:**
6 July 2016 (06.07.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
15175443.9 6 July 2015 (06.07.2015) EP
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(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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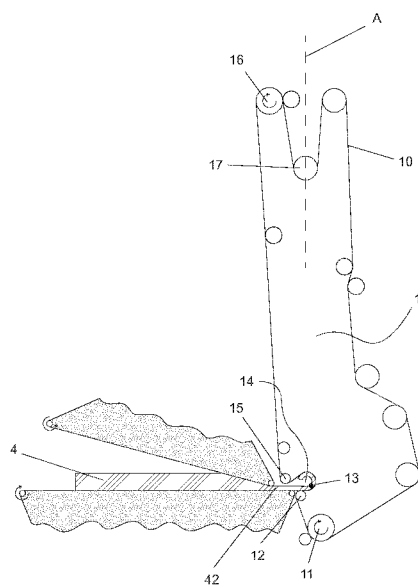
(54) **Title:** MINERAL WOOL PACKAGER

Fig. 2

(57) **Abstract:** The present invention relates to a method where rolling a length of compressed flexible material (4) into a roll (43) use a flexible roll-up belt (101, 102) moving along a belt pathway, said pathway defined by a number of rollers (5, 19), wherein at least one of said rollers (5) is active where its rotation is driven by a drive motor and drives the belt along said belt pathway, the roll-up belt can be tightened or loosened along said belt pathway by changing the position of at least one moveable roller (17) and thereby changing the length of the pathway, wherein said method comprises feeding said compressed flexible material (4) into a meeting loop cavity (14) shaped by a segment of said roll-up belt (101, 102) along said roll-up belt pathway, whereby material follows the inner surface of the loop and the rolling of the flexible material is initiated, gradually increasing the length of the segment of said roll-up belt in said meeting loop cavity (14) to ensure that that the roll-up belt segment in said meeting loop cavity gradually and continuously follows the increasing size of the roll (43) and supports the outer contour of the roll, wherein said gradual increase of the segment comprises the steps of gradually loosening the roll-up belt (101, 102) by changing the position of said at least one moveable roller (17) and simultaneously controlling the rotation speed of said at least one active roller (5) to control the length of said belt segment in said meeting loop cavity. Thereby, an automatic rolling of flexible material (4) is obtained, which adaptably expands a meeting loop cavity (14) to ensure that the rolling is initiated in a controlled manner, and furthermore, that one apparatus (1) performing the method according to the present invention may be used to roll flexible material of various dimensions and characteristics.

**Declarations under Rule 4.17:**

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

TITLE: MINERAL WOOL PACKAGER

FIELD OF THE INVENTION

The present invention relates to a method and apparatus for rolling and packaging
5 compressed flexible material such as mineral wool.

DESCRIPTION OF PRIOR ART

Insulation wool is used for insulating e.g. houses in order to reduce energy loss. Insulation
wool is a material comprising a lot of air and in order to save space both when transporting,
10 storing and handling the material, it is an advantage to compress the material before
packaging. Obviously, this is not only an advantage when it comes to insulation wool, but
also other material comprising air, such as foam used in inter alia furniture, e.g. in
mattresses, could be compressed to save space.

15 It is known to stack and compress compressible products, such as insulation wool, in the
same process. Another method of compressing and packaging wool is to compress and roll
the wool in wool rolls. Using rolls can be advantageous in situations where large segments
are to be covered by wool, which can be done much faster by just rolling out the roll instead
of having to position a number of product pieces next to each other.

20

When rolling wool rolls, it is of interest to maintain the optimum compression while rolling
and further especially when initiating the rolling, the first part of the wool length may be over-
compressed, resulting in plastic deformation of the wool, whereby it does not regain its full
size when unpacked, and thereby does not regain its proper isolative properties. Another
25 problem is that in the known methods of rolling, the first rounds of rolling cannot be optimally
controlled, which often results in the first roll rotations being quite random thus bending the
material in various directions.

SUMMARY OF THE INVENTION

30 It is an object of the present invention to solve at least some of the above-mentioned
problems.

This is obtained by a method where rolling a length of compressed flexible material into a roll use a flexible roll-up belt moving along a belt pathway, said pathway defined by a number of rollers, wherein at least one of said rollers is active where its rotation is driven by a drive motor and drives the belt along said belt pathway, said roll-up belt can be tightened or
5 loosened along said belt pathway by changing the position of at least one moveable roller and thereby changing the length of the pathway, wherein said method comprises feeding said compressed flexible material into a meeting loop cavity shaped by a segment of said roll-up belt along said roll-up belt pathway, whereby material follows the inner surface of the loop and the rolling of the flexible material is initiated, gradually increasing the length of the
10 segment of said roll-up belt in said meeting loop cavity to ensure that that the roll-up belt segment in said meeting loop cavity gradually and continuously follows the increasing size of the roll and supports the outer contour of the roll, wherein said gradual increase of the segment comprises the steps of gradually loosening the roll-up belt by changing the position of said at least one moveable roller and simultaneously controlling the rotation speed of said
15 at least one active roller to control the length of said belt segment in said meeting loop cavity.

In an embodiment of the invention, it relates to an apparatus adapted to perform this method.

By compressed flexible material is understood any material having a substantial elastic
20 compression range, or in other words, that the material is able to fully recover from considerable compression, such as 30% or 90% compression, regaining substantially its original volume and dimensions. Mineral wool is a typical type of such a materials, such as glass wool, slag wool or stone wool. Typically, this elastic compressibility is obtained at least in part by a high air content, possibly with open cells, where air is free to travel in and out of
25 the material. By wool is understood this flexible material in either compressed or uncompressed form.

In the present invention, a roll-up belt is used, which is usefully flaccid and stretched in different regions over time. By a loosened belt is understood a portion of a belt where the distance it covers is less than the distance coverable by the same belt portion without damaging the belt, or, in other words, a flaccid belt or a slack belt. In reality, the belt is never
5 completely flaccid, slack or loose, but comparatively so, relative to other portions and at other times. The flaccidness may be understood as a descriptor of regions able to supply excess belt.

By the method described, an automatic rolling of flexible material is obtained solving the
10 above-mentioned problems by letting the adaptably expanding meeting loop cavity ensure that the rolling is initiated in a controlled manner, and furthermore, that one machine may be fitted to roll flexible material of various dimensions and characteristics.

In an embodiment of the invention, it relates to a method wherein at least two of said rollers
15 are active and wherein gradually increasing the length of the segment of said roll-up belt in said meeting loop cavity comprises controlling the rotation speed of at least one of said at least two active rollers along said belt pathway.

In an embodiment of the invention, it relates to an apparatus adapted to perform this method.
20

By controllably is understood that the speed is adaptable during operation. Conveniently, one of the active rollers may drive the belt instead at a reference speed and its speed may not be controllable. In this embodiment, another active roller then adaptably controls the meeting loop cavity expansion. In another embodiment of the invention, both are
25 controllable. The expansion of the meeting loop cavity can be precisely controlled by using the two active rollers at different speeds.

In an embodiment of the invention, it relates to a method, wherein the compression of the wool is obtained by moving the wool between an upper feed belt and a lower feed belt, and wherein the feed belts are inclined relative to each other, whereby the distance between their transport surfaces decreases in their transport direction. Thereby, the compression of the insulation material moving along the surface of the lower compression belt is gradually increased.

In an embodiment of the invention, it relates to an apparatus, wherein said belt pathway comprises a first pathway segment defining a route between said two active rollers and a second pathway segment defining another route between said two active rollers, wherein said moveable roller is located along said first pathway segment and said meeting loop cavity is located along said second pathway segment. By disallowing free travel from the moveable roller to the meeting loop cavity and instead leading the belt along active rollers, the belt feed to the meeting loop cavity can be precisely controlled.

15

In an embodiment of the invention, it relates to an apparatus comprising at least one limiter unit, where said at least one limiter unit is adapted to reduce the speed of said belt along said belt pathway, and where said limiter unit is positioned along said belt pathway after said meeting loop cavity in the belt moving direction. By using a limiter unit, control over belt movement may be achieved. By positioning the limiter unit downstream of the meeting loop cavity and activating the limiter unit while keeping active rollers at an unaltered speed, the belt portion inside the meeting loop cavity is increased.

In an embodiment, the limiter unit is a passive roller or an active roller. By having the limiter unit be a roller, friction and wear on the belt is reduced. The limiter unit may be an active roller providing a reduction of speed by actively rotating at lower speeds than the oncoming belt, or it may be a passive roller fitted to supply a static or dynamic speed reduction.

25

In an embodiment of the invention, it relates to an apparatus, wherein said limiter unit is the first roller positioned along said belt pathway after said meeting loop cavity in the belt moving direction. By positioning the limiter unit immediately after the meeting loop cavity in the belt moving direction, or in other words downstream relative to the meeting loop cavity, control
5 over meeting loop cavity expansion is maximized relative to other positions of the limiter unit. In addition, feedback delay is avoided or reduced.

In an embodiment of the invention, a method whereby gradually increasing the length of the segment of said roll-up belt in said meeting loop cavity comprises decreasing the pull onto
10 said belt inside said meeting loop cavity from downstream said meeting loop cavity. For example, brakes may be employed, whereby the effectiveness of the expansion of the cavity may be easily seen and optimized to different materials and speeds, while allowing the system to operate at optimum efficiency ranges. In an embodiment of the invention, it pertains to an apparatus adapted to perform this function by decreasing the speed of the
15 downstream belt with a limiter unit. The limiter unit may be a brake or it may be a motor adapted to be able to brake or any other unit able to slow down the belt. In one embodiment, an upper inlet roller is the limiter unit. By using an upper inlet roller as limiter unit, travel time between the meeting loop cavity and the limiter unit is minimized, allowing quick feedback and thus control of the rate of expansion of the meeting loop cavity.

In an embodiment of the invention, the pressure of said flexible material onto said belt as it meets the belt inside said meeting loop cavity is enough to gradually increase the length of the segment of said roll-up belt by drawing belt into said meeting loop cavity. In another embodiment of the invention, it pertains to an apparatus adapted to perform this method.

- 5 This is normally not possible because inertia in the belt along its path necessitates releasing substantially more belt and slacking the belt considerably before the resistance has decreased enough for expanding the cavity in this way. Another problem produced by this is that the rate of expansion of the cavity is then not controlled. By matching the inertia of the belt with a first upstream active roller feeding flaccid belt, a situation may be produced
- 10 where a push onto the side of the belt at the meeting loop cavity draws belt from the upstream active roller, expanding the cavity. By having the first active roller substantially immediately upstream relative to the meeting loop cavity, unnecessary intermediate pathway is avoided, which would act as a buffer for feeding belt and so increase belt inertia. Another complimentary route to achieve this effect is to use as few passive rollers as
- 15 possible between the first active roller and the cavity, since passive rollers increase inertia. Yet another way to achieve the same effect is to decrease or eliminate horizontal pathways between the first active roller and the cavity, as these are affected substantially by gravity to increase belt inertia.
- 20 Depending on the degree of matching of these forces, the sensitivity of the belt in the meeting loop cavity may be adjusted to a fitting level. By this adjustment, the mineral wool packager may be fitted to compress and pack wools of different materials and thicknesses.

In an embodiment of the invention, it relates to a method, wherein the neck of the meeting

25 loop cavity is narrowed as the cavity is expanded and the roll size increased. By narrowing the neck is meant that the opening of the cavity is made smaller. This allows the wool to touch, thus promoting rolling and not allowing it to leave the cavity along the belt, even for different thicknesses of wools. In an embodiment of the invention, it relates to an apparatus adapted to narrow the neck.

In an embodiment of the invention it pertains to an apparatus where said loop cavity is retained by fingers, said fingers protruding onto said belt inside said meeting loop cavity. These fingers do not protrude deeply enough to obstruct the path of the flexible material. Thereby, feeding belt to the cavity has the predictable effect of expanding the cavity inwards.

5 Without any guidance, the belt making up the cavity might hang out and so feeding belt would simply increase the protrusion of the belt outwards. By the fingers not extending fully inwards onto the belt, they are adapted to not obstruct the path of the wool, making their use considerably simpler. In an embodiment of the invention, the fingers are mechanically removable, which allows for them to be withdrawn to roll materials in the cavity with broader

10 profiles without obstruction, such as plastic packaging, which is often broader than the wools they are fitted to package.

SHORT LIST OF DRAWINGS

Fig. 1 is a side view of the mineral wool packager at a time prior to formation of a wool roll.

15 Fig. 2 is a side view of the mineral wool packager at the beginning of formation of a wool roll.

Fig. 3 is a side view of the mineral wool packager almost finished rolling the wool.

20 Fig. 4 is a side view of the mineral wool packager as it has released the finished roll.

DETAILED DESCRIPTION OF DRAWINGS

Figures 1 – 4 illustrates the process of making rolls of flexible, compressed material

25 according to the present invention.

Fig. 1 illustrates the mineral wool packager 1 prepared to form a roll of wool 4. Furthermore, it also illustrates the wool being compressed 41 between two feed-belts 2, 3 adapted to receive the wool between the two belts. Each belt is a conventional transporting belt, where

30 a belt rotates around rollers and the rotating direction and also the transport direction are illustrated by the arrows 5.

The upper compression belt 3 is mounted in an inclined manner relative to the lower compression belt 2, whereby the distance decreases between the two belts in the transport direction of the transporting belt. This decrease in distance compresses the insulation material between the belt as the insulation is moved along the transport belts. One or both
5 of the feed-belts 2, 3 are at least vertically moveable, thus affording control over the degree of compression 41, achieving an appropriate thickness of compressed wool 42. This allows multiple thicknesses and types of wool to be inserted into the mineral wool packager at their effective compressions, such as appropriately compressing stone wool with a thickness of ten and thirty centimetres respectively.

10

The embodiment of the mineral wool packager according to fig. 1 consists of a roll-up belt fitted onto a number of passive rollers 12, 12', 17, 19, 181 as well as two active rollers 11, 16, driving the movement of the belt by rotating, this rotation provided by drive motors. Most of the passive rollers 12, 19 have as function to define the belt pathway, while other passive
15 rollers 12', 17, 181 have further functions as well, as described in the following. The mineral wool packager has a controllably moveable roller 17, whose displacement along axis A shortens or lengthens the belt pathway, thereby either slacking or tightening the belt. In fig. 1 this displacement is vertical, but in other embodiments, the displacement may be horizontal or any other angle.

20

In one embodiment, a motor controls the movement along axis A. In one embodiment where axis A is at least substantially vertical, a counterweight is attached to the moveable roller 17, whereby the gravity of the counterweight substantially equals the upwards pull by the belt being tight, which allows the motor attached to moveable roller 17 to operate with less
25 frequency and with less power.

Furthermore, along the roll-up belt pathway, an expandable meeting loop cavity 14 is located, so that compressed wool 42 encountering the belt 10 enters this cavity. In fig. 1, this cavity is illustrated in its initial, contracted position. In an embodiment of the invention, the belt pathway is kept expanded into the cavity-shape by two fingers 13 in the contracted position. Because the belt 10 is broader than compressed wool 42, the fingers 13 holds the belt in the cavity, but adapted to not protrude deeply onto the belt, whereby they do not obstruct the path of the wool as it enters the cavity. Thereby, the fingers hold the belt in a minimal cavity size but does not obstruct the wool from pressing against the cavity. In an embodiment, the fingers 13 are mechanically removable during operation, allowing broader profiles of for example plastic film to roll unobstructed into the cavity at a convenient time, for example allowing packaging the wool in an outer packaging layer.

The belt 10 is rotated by at least one active roller 11. This active roller is controllable, by which is understood that it has a controllably variable speed. This speed is adapted based on the need for loose belt in the meeting loop cavity. By having a controllably variable speed, belt feed to the cavity can be precisely controlled, whereby wool of varying materials and thicknesses can be rolled in the mineral wool packager according to the invention. In addition, the mineral wool packager according to the invention is thus adapted to supply a tightly fitting cavity and a precisely paced expansion, even as the machine becomes older and tolerances creep.

In the embodiment shown in figs. 1 – 4, the roller 16 is an active roller. According to the invention, the roller 16 might also be a passive roller.

In the embodiment shown, two active rollers 11, 16 are provided, where the direction of the rotation of these is seen by rotational arrows 5. Counter-rollers 111, 161 are used to ensure the grip of the active rollers onto the belt to ensure a high degree of power transfer as well as a controlled belt displacement. By having one or two active rollers 11, 16, one of which is controllable, driving the belt 10 and a mechanically controlled moveable roller 17, the exact amount of belt fed to the meeting loop cavity can be controlled.

When the moveable roller 17 is moved upwards, the belt initially becomes loose. The geometry of the belt pathway will determine where the flaccidity expresses itself the most. If the active rollers operates normally following the belt becoming flaccid, the flaccidness will travel along the belt pathway and will likely result in a concave line immediately before the first active roller 11 as well as a slightly more flaccid pathway upstream of the first active roller all the way to the second active roller.

The first active roller is not a passive roller; however, the flaccidness is substantially kept at a first belt-segment 101 corresponding to upstream relative to the first active roller, and between the two active rollers, while the flaccidness cannot enter a second belt-segment 102 corresponding to downstream from the first active roller and between the two active rollers. In other words, while the two active rollers displace the belt at the same speeds, flaccidness on one belt-segment 101 or 102 cannot travel to the other segment. Substantially, only by operating the active rollers at different speeds the flaccidness may travel between belt segments.

Thereby, the amount of flaccid belt fed to the meeting loop cavity is precisely controlled. Furthermore, because the first active roller is placed substantially immediately upstream of the meeting loop cavity, the wool pressing against the belt inside the meeting loop cavity does not need to overcome the forces inherent in drawing belt from a concave belt line under the mineral wool packager to expand the cavity, but instead the first active roller actively feeds flaccid belt at a rate matching the rate of inserted wool, accounting for wool thickness and type. In one embodiment of the invention, the first active roller is adapted to respond to the wool pressing against the belt, feeding belt according to forces sensed from the belt.

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Fig. 2 illustrates an embodiment of the present invention, where the compressed wool 42 is beginning to be formed into a roll inside the meeting loop cavity 14. The moveable roller 17 is moved upwards, shortening the belt pathway, allowing the first active roller 11 to feed flaccid belt to the cavity 14, which is then expanded by the compressed wool 42.

30

Edge rollers 12, 12' define the outer edges of the meeting loop cavity, and in one embodiment, one or both of them are moveable, allowing the meeting loop cavity to substantially close as the roll of wool is being formed. This ensures that the wool cannot leave the meeting loop cavity, as the height between the edge rollers 12, 12' may be
5 adjusted to less than two times the height of the compressed wool. The wool traveling along the roof of the cavity may by its own weight fall onto the wool traveling along the floor of the cavity. However, if this does not happen by itself as may be the case for thicker wools especially, the gap between inlet rollers 12, 12' being less than two times the height of the compressed wool, ensures contact between the upper and the lower layer. Friction between
10 the two layers ensure a bend at the tip of the wool traveling at the roof, whereby the formation of the roll is initiated with no or minimal plastic deformation of the wool.

To improve this function and reduce plastic deformation of the wool, especially in the beginning of the roll formation, it is useful to control the geometry of the cavity precisely,
15 such as by controllably feeding loose belt to the cavity. This may for example be according to the rate of insertion of wool, as well as the type and thickness of wool used. By this adaptation, the cavity can be so small as to force the upper layer of wool to travel along the lower layer for the entire length of the cavity (not shown), thereby creating friction, which initiates the rolling. Alternatively, a larger cavity can be created, allowing the upper layer to
20 fall onto the incoming layer by way of gravity, as seen in fig. 2. Depending on wool characteristics such as thickness, stiffness and friction, the amount of flaccid belt fed may vary. In one embodiment, the belt feed during roll initiation may be non-linear or stop entirely or even reverse momentarily. An example may be quickly feeding a large amount of belt to the cavity, whereby a large cavity is created, ensuring that the wool has relatively far to travel
25 along the roof of the cavity. When the wool bends and falls down and initiates rolling, the cavity may then for example be contracted again, ensuring a tight fit and so retaining the compression.

Since the fingers 13 do not protrude deeply enough onto the belt to touch the compressed
30 wool, it does not hinder the movement of the wool, and the wool thus passes between the fingers, illustrated in fig. 2 and fig. 3 with the compressed wool 42 and fingers 13 overlapping.

In fig. 3, the moveable roller is further displaced along axis A, allowing the meeting loop cavity 14 to attain a desired size for a wool roll 43. After the roll has attained the desired size, an outer layer, for example of plastic film, is fed conveniently along the upper feed-belt 3 and into the meeting loop cavity, thereby encapsulating the wool roll. This allows the roll
5 to retain its compression even after removal from the mineral wool packager.

In fig. 4, the bottom of the mineral wool packager is rotated substantially sideways around a roller 181, allowing the packaged wool roll out of the meeting loop cavity. Machine section 18 is rotated around roller 181, whereby the wool roll is expelled, ready for further
10 processing, storage and/or transportation. The roller 17 is displaced to accommodate any changed belt pathway distance between rollers 12 and 12', corresponding to the meeting loop cavity of figs. 1 - 3.

By subsequent reversing the rotation of machine section 18 around roller 181 and
15 correspondingly tightening the belt pathway by roller 17 to ensure a tight fit around fingers 13, the mineral wool packager is returned to a position corresponding to the one depicted in fig. 1.

REFERENCE NUMBERS

- 1. Mineral wool packager
- 10. roll-up belt
- 101. first belt section
- 5 102. second belt section
- 11. first active roller
- 111. counter-roller of first active roller
- 12. lower edge roller
- 12'. upper edge roller
- 10 13. fingers
- 14. meeting loop cavity
- 16. second active roller
- 161. counter-roller of second active roller
- 17. moveable roller
- 15 18. machine section
- 181. passive roller
- 19. passive roller
- 2. first feed-belt
- 3. second feed-belt
- 20 4. wool
- 41. wool being compressed
- 42. compressed wool
- 43. wool roll
- 5. rotational movement
- 25 A. axis

CLAIMS

1. A method of rolling a length of compressed flexible material into a roll using a flexible roll-up belt moving along a belt pathway, said pathway defined by a number of rollers, wherein at least one of said rollers is active where its rotation is driven by a drive motor and drives the belt along said belt pathway, said roll-up belt can be tightened or loosened along said belt pathway by changing the position of at least one moveable roller and thereby changing the length of the pathway, wherein said method comprises
- 10 - feeding said compressed flexible material into a meeting loop cavity shaped by a segment of said roll-up belt along said roll-up belt pathway, whereby material follows the inner surface of the loop and the rolling of the flexible material is initiated,
 - 15 - gradually increasing the length of the segment of said roll-up belt in said meeting loop cavity to ensure that that the roll-up belt segment in said cavity gradually and continuously follows the increasing size of the roll and supports the outer contour of the roll,
 - 20 - wherein said gradual increase of the segment comprises the steps of gradually loosening the roll-up belt by changing the position of said at least one moveable roller and simultaneously controlling the rotation speed of said at least one active roller to control the length of said belt segment in said meeting loop cavity.
2. A method according to claim 1, wherein at least two of said rollers are active and wherein gradually increasing the length of the segment of said roll-up belt in said meeting loop cavity
- 25 comprises controlling the rotation speed of at least one of said at least two active rollers along said belt pathway.
3. A method according to claims 1 – 2, wherein the compression (41) of said flexible material is obtained by moving the flexible material (4) between an upper feed belt (3) and a lower
- 30 feed belt (2), and wherein the feed belts are inclined relative to each other, whereby the distance between their transport surfaces decreases in their transport direction.

4. An apparatus for rolling a length of compressed flexible material into a roll, said apparatus comprising

- 5 - a flexible roll-up belt moving along a belt pathway being defined by a number of rollers,
- at least one active roller where its rotation is driven by a drive motor and where said at least one active roller drives the belt along said belt pathway,
- a moveable roller, where the roll-up belt can be tightened or loosened along said belt pathway by changing the position of said moveable roller and thereby
- 10 changing the length of the pathway,
- a meeting loop cavity shaped by a segment of said roll-up belt along said roll-up belt pathway, for receiving said length of compressed flexible material to be rolled,
- means for gradually increasing the segment by gradually loosening the roll-up belt by changing the position of said at least one moveable roller and simultaneously
- 15 controlling the rotation speed of said at least one active roller to control the length of said belt segment in said meeting loop cavity.

5. An apparatus according to claim 4, comprising at least two active rollers.

- 20 6. An apparatus according to claim 5, wherein said belt pathway comprises a first pathway segment (101) defining a route between said two active rollers and a second pathway segment (102) defining another route between said two active rollers, wherein said moveable roller (17) is located along said first pathway segment (101) and said meeting loop cavity (14) is located along said second pathway segment (102).

25

7. An apparatus according to any of the preceding claims 4 – 6, further comprising at least one limiter unit, where

- said at least one limiter unit is adapted to reduce the speed of said belt along said belt pathway, and where said limiter unit is positioned along said belt pathway
- 30 after said meeting loop cavity in the belt moving direction.

8. An apparatus according to claim 7, wherein said limiter unit is a passive roller or an active roller.

9. An apparatus according to claim 8, wherein said limiter unit is the first roller positioned
5 along said belt pathway after said meeting loop cavity in the belt moving direction.

10. An apparatus according to any of the preceding claims 4 – 9, where said loop cavity is retained by fingers (13), said fingers protruding onto said belt (10) inside said meeting loop cavity (14).

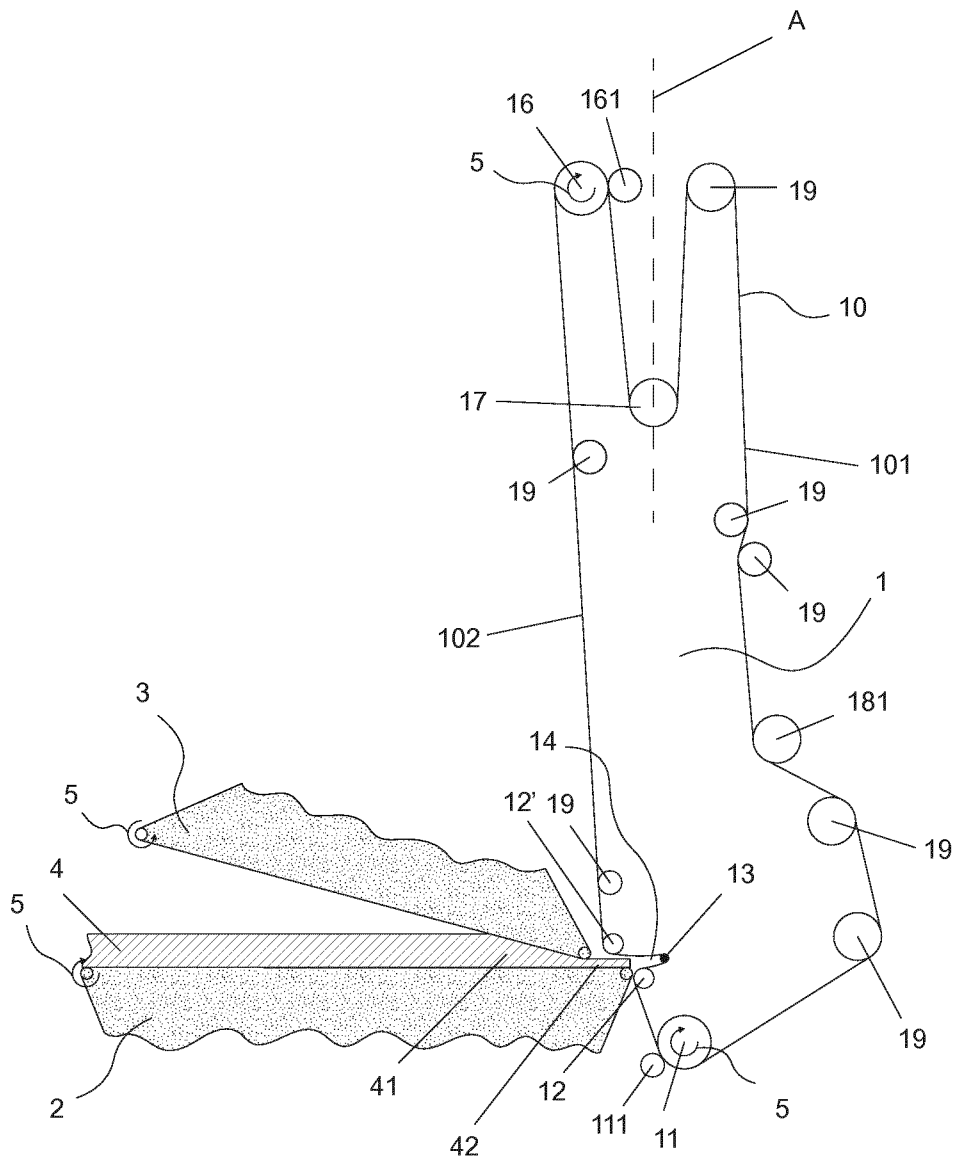


Fig. 1

2/4

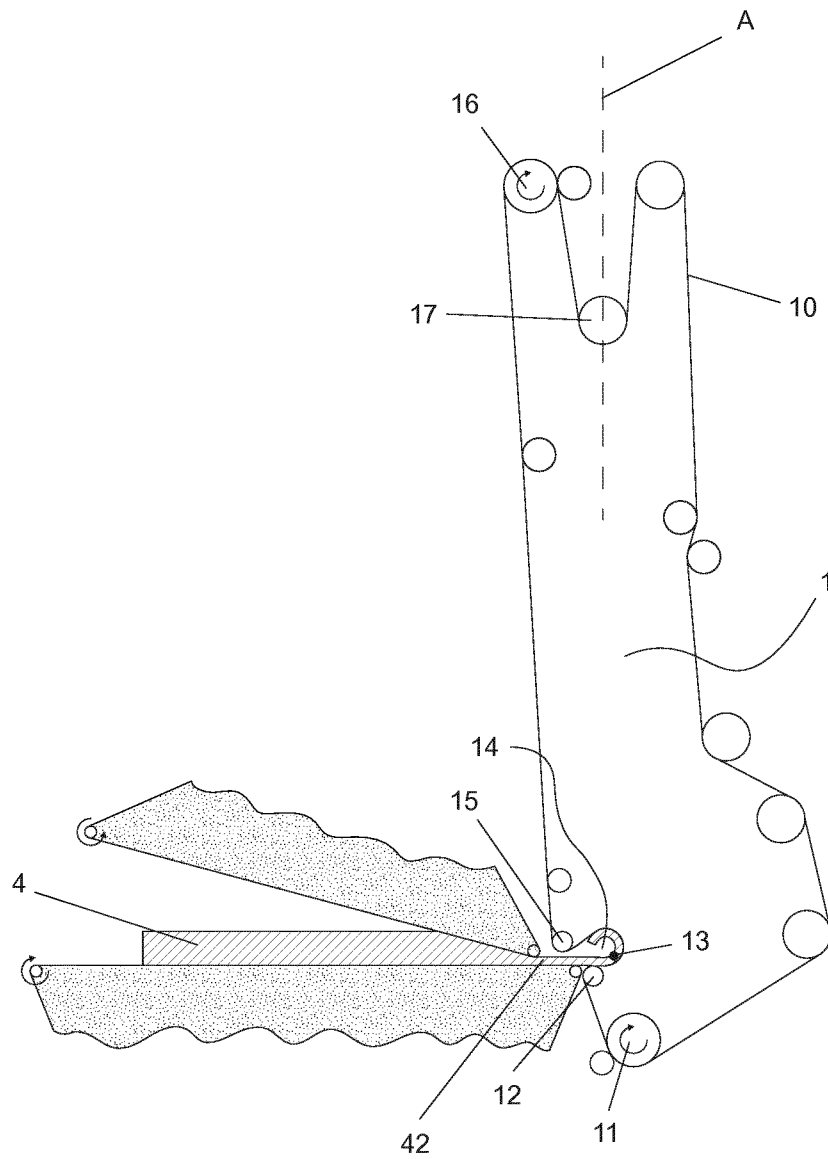


Fig. 2

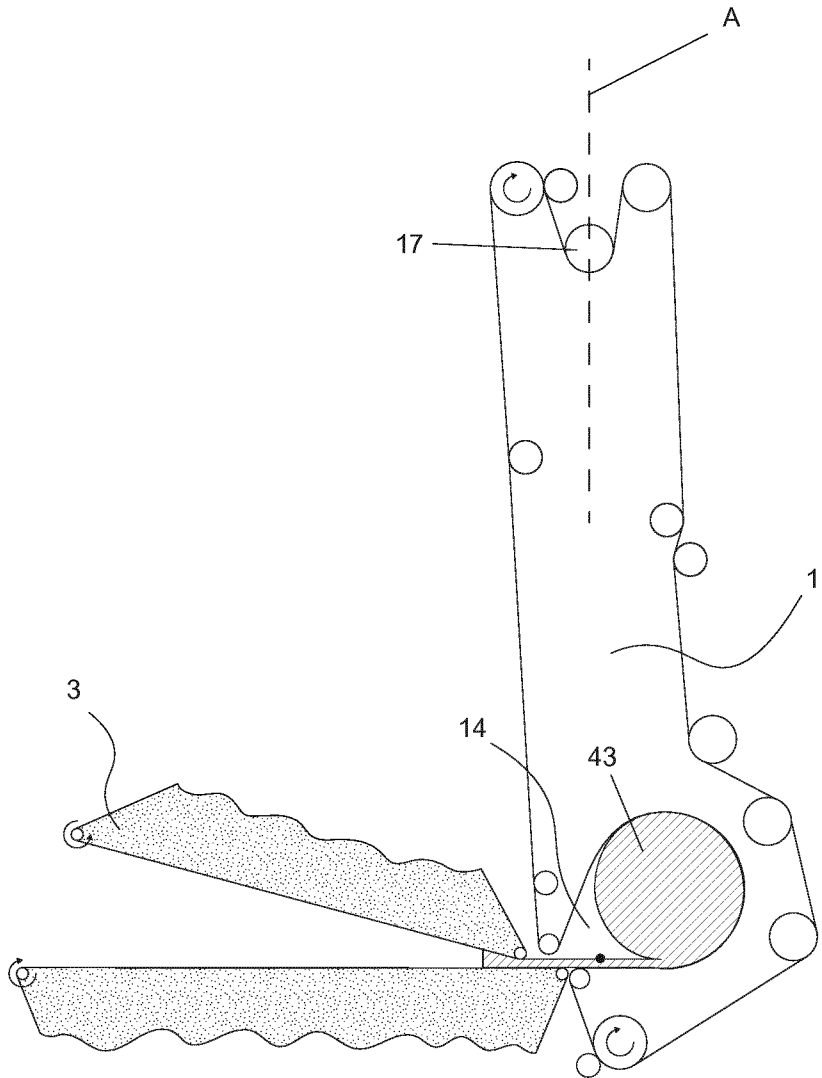


Fig. 3

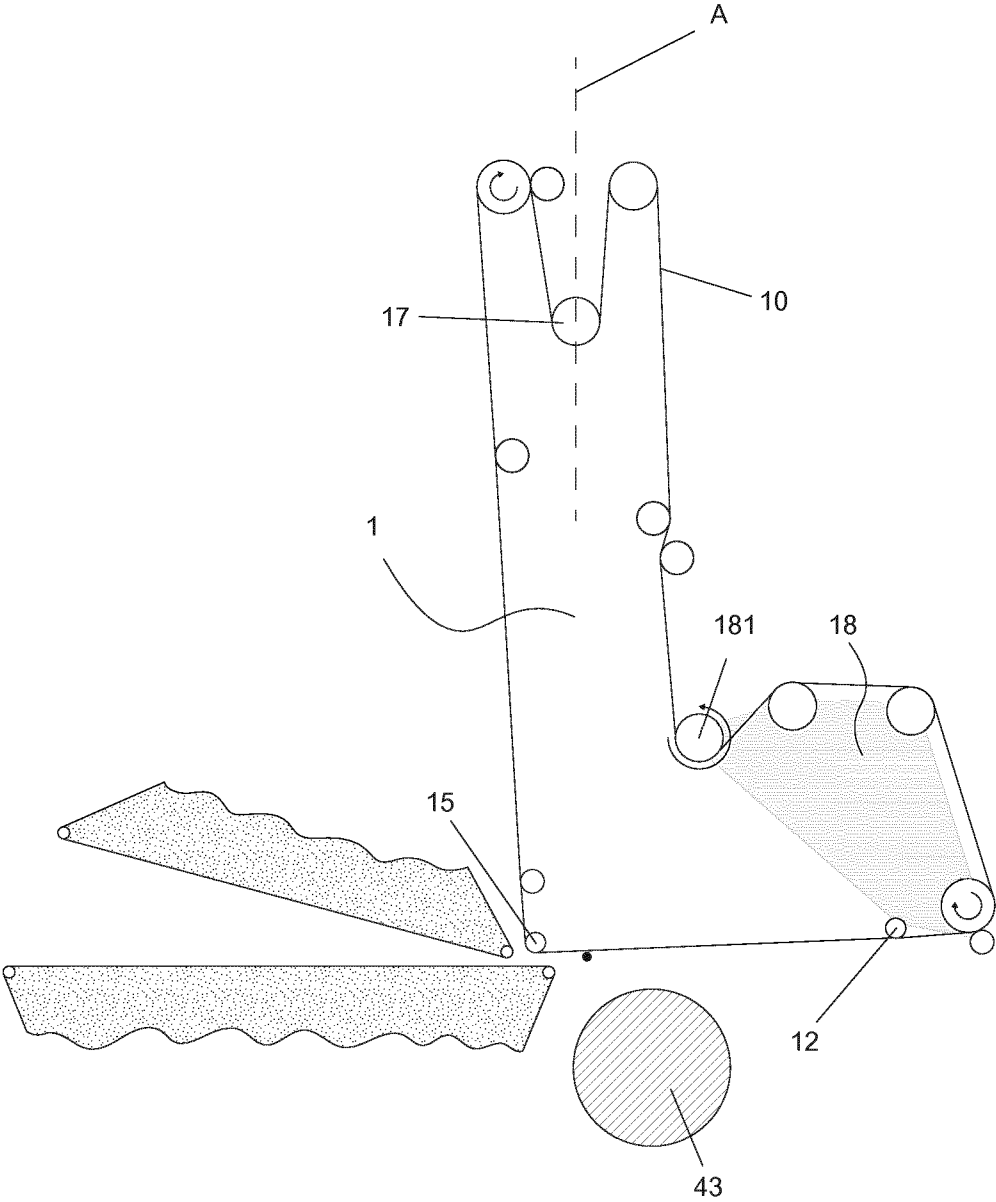


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/065949

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65H18/22
ADD.

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)
B65H

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

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

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 164 177 A (CANFIELD SHELDON A [US]) 14 August 1979 (1979-08-14) the whole document	1,2,4,5
Y	-----	3
A	-----	6-10
Y	EP 0 551 228 A1 (SAINT GOBAIN ISOVER [FR]) 14 July 1993 (1993-07-14) page 1, line 53 - page 2, line 4; figures	3
Y	-----	3
Y	DE 299 23 197 U1 (ROCKWOOL MINERALWOLLE [DE]) 6 July 2000 (2000-07-06) claims 1,11; figure 2 -----	3



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

19 September 2016

Date of mailing of the international search report

27/09/2016

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/065949

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