

Description

[0001] The present invention relates to an apparatus for rolling up compressible fibrous materials.

[0002] In particular, the invention relates to formation of rolls starting from bands or ribbons of compressible fibrous materials such as mineral-fibre felts intended for use typically in the building field for heat insulation and/or soundproofing of walls, attics and so on.

[0003] It is known that mineral-fibre felts, such as felts made of glass wool, are widely used for heat insulation or soundproofing purposes in a variety of fields and, as above mentioned, they particularly apply to the building field.

[0004] The insulation capabilities, both as regards heat insulation and soundproofing, of felts made of glass wool depend, as known, on the felt thickness.

[0005] On the other hand, in order to make mineral-wool ribbons commercially desirable, packaging techniques capable of greatly minimizing the volume taken up by felts have been increasingly widespread.

[0006] From the above it appears that, on the one hand, the glass wool felt thickness is required to be maximum during setting up so, as to ensure high performance in terms of heat insulation/soundproofing and, on the other hand, there is an opposite requirement of minimizing the volume taken up by the felts in order to enable an easy and cheap transportation of same.

[0007] In order to meet these requirements, different packaging techniques have been set up in the past which consist in rolling up the glass wool ribbon under compressed conditions, so as to form a cylindrical roll capable of being stably housed in an outer envelope of paper or plastic material so that transportation of same can take place without taking up too much room.

[0008] Possibly, from the point of view of bulkiness, it is certainly useful that the felt thickness should be reduced as much as possible although, on the other hand, the springing-back capability of the product, when the latter is disengaged from package and then installed, is to be taken into due account too.

[0009] In order to ensure an efficient reduction in volumes and at the same time an efficient material spring-back on installation, it is absolutely necessary that:

1. the whole ribbon submitted to packaging should be compressed in a uniform manner and to an extent as much as possible closest to the springing-back limit of the product;
2. during packaging, tearing and in particular delamination of the fibrous material should be avoided, as this would involve unevenness and structural discontinuity in the fibrous material and, as a result, unevenness in the subsequent operating behaviour of same.

[0010] In an attempt to reach the above mentioned results, the following packaging techniques involving roll

formation have been presently used.

[0011] According to one technique, the glass wool ribbon is led through a space delimited by two conveyor belts and a pressure roller. In particular, the conveyor belts are inclined and converge towards each other so as to define a predetermined solid angle, whereas the pressure roller is disposed within the solid angle formed by the two above mentioned belts at a given distance from the ideal corner defined by the latter. The conveyor belts and roller draw the felt in a rotation movement about itself. In particular the pressure roller is displaced in such a manner that the space in which the glass wool roll is being formed progressively increases. Depending on the different embodiments, the pressure roller is suitably counterbalanced and is allowed to move freely during formation of the glass wool roll (packaging by passive compression), or it is moved by appropriate drive means and control members following a law previously set by the apparatus (rolling up by active compression).

[0012] Obviously, apparatuses provided with an active control on the pressure roller are capable of performing a continuous adjustment of the action exerted by the roller on the felt, so that an as much as possible uniform compression and felt processing is carried out during the whole rolling-up operation.

[0013] A rolling-up apparatus providing an active compression control is disclosed widely and in detail in European Patent No. EP-0 140 785, to which please refer for further information.

[0014] Practically, in accordance with teachings in the European Patent No. EP-0 140 785, rolling up is controlled by an active intervention of the pressure roller imposing a predetermined thickness, which is preferably constant or slightly decreasing during rolling, to each coil of the felt being rolled up, in order to substantially achieve a uniform compression over the whole felt length, so that, during the installation step, a product having a uniform spring-back and, as a result, constant insulation features over the whole longitudinal extension thereof, is correspondingly obtained.

[0015] While rolling-up apparatuses provided with an active-compression roller have been widely used, they however have highlighted some serious drawbacks.

[0016] Firstly, compression carried out by the roller takes place by suitably managing the radial position of the roller relative to the glass wool roll being formed and the peripheral speed of the pressing roller itself. It is well apparent that, since arrangement of sophisticated and precise devices for controlling the roller position and speed depending on the number of rolled-up coils is required, the packaging apparatus can become, on the whole, very complicated.

[0017] Still more important is the fact that said pressure roller, by working on the coils being formed, exerts a compression action on the last rolled-up coil and this action necessarily also affects, deforms and presses coils already submitted to compression in the preceding

steps. This inevitably gives rise to the fact that the pressure roller is substantially unable to ensure a really uniform treatment of the fibrous material being processed, over the whole longitudinal extension of said material.

[0018] Finally, also important is the fact that the pressure roller, in addition to exerting a given radial action on the coils of the fibrous material, certainly also exerts a tangentially-directed strong action. This inevitably gives rise to tangential stresses at the contact areas between the fibrous material and the pressure roller surface, which stresses very often cause delaminations of the fibrous material, breakage of many fibres and, as a result, a substantial incapability of springing back of the material at the delamination regions.

[0019] It is finally to point out that typically rolling-up devices involving an active compression produce an action on the perimeter of the roll being formed that gives rise to some deformation in the shape of the transverse section of said roll, which deformation may jeopardise the final step of applying an outer paper sheath to the roll for blocking the fibre roll once the latter has reached the desired diameter sizes, or make this final step difficult.

[0020] Under this situation, it is a fundamental object of the present invention to provide a new apparatus for packaging fibrous compressible materials in the form of rolls, which is capable of improving the traditional-apparatus behaviour.

[0021] In particular, it is a fundamental object of the invention to provide an apparatus capable of ensuring rolling up of compressible fibrous materials while minimizing the delamination problem of the material, achieving a high and uniform compression of the material being processed and finally allowing an as much as possible cylindrical roll to be obtained, i.e. a roll devoid of marked deformations in its transverse section.

[0022] It is also a further object of the invention to provide an apparatus which is of simple structure, easy operating control and, as a result, easy and cheap installation.

[0023] The foregoing and further objects that will become more apparent in the progress of the following description are substantially achieved by an apparatus for rolling up compressible fibrous materials in accordance with the features recited in the appended claims.

[0024] Further features and advantages will be more fully understood from the detailed description of a preferred, non-exclusive embodiment of an apparatus for rolling up compressible fibrous materials in accordance with the present invention. This description will be taken hereinafter, by way of non-limiting example, with reference to the accompanying drawings, in which:

- Fig. 1 is a diagrammatic side view showing an apparatus in accordance with the present invention;
- Fig. 2 shows a portion of the apparatus seen in Fig. 1, in more detail.

[0025] With reference to the drawings, an apparatus for rolling up compressible fibrous materials in accordance with the present invention has been generally identified by reference numeral 1.

[0026] In particular, it is to note that apparatus 1 will be adapted for use in rolling up materials such as mineral-fibre ribbons or bands, such as felts made of glass wool.

[0027] Apparatus 1 comprises at least one conveyor member 2, and at least one deflection member 3, preferably consisting of respective conveyor belts such disposed as to define a solid angle (Y) of predetermined opening.

[0028] More specifically, as shown in the accompanying drawings, the conveyor belt 2 has a corresponding operating stretch 4a, the horizontal one in this case, over which the ribbon of compressible fibrous material 5 to be rolled up is placed. In turn, the deflection member (belt) 3 operates at an end region 2a of the conveyor belt 2 and has a respective operating stretch 4b defining a solid angle (Y) with the mentioned operating stretch 4a; a roller 6 is disposed within the angle (Y) and, in cooperation with the conveyor belt 2 and deflection belt 3, it defines a rolling-up space 7 inside which a roll 8 of fibrous material is being gradually formed.

[0029] It is to note that the conveyor belt 2 causes movement of the compressible fibrous material 5 in a predetermined direction and feeding speed, diagrammatically shown by arrow 9, towards the rolling-up space 7. As the roll of fibrous material 8 is being formed and hence its radial sizes increase, the above mentioned roller 6 moves away from the ideal corner 10 of the solid angle (Y) defined by the conveyor belt 2 and deflection belt 3. It will be recognized that roller 6 placed inside the solid angle (Y) is rotatable about a rotation axis 11 orthogonal to the feeding direction 9 of the fibrous material 5 and parallel to the ideal corner 10 defined by the solid angle extending between the conveyor belt 2 and deflection belt 3. In other words, the rotation axis of roller 6 is substantially parallel to the ideal rolling-up axis of the fibrous material.

[0030] In an original manner, apparatus 1 also comprises a precompression device 12 operating upstream of the rolling-up space 7 relative to the feeding direction 9 of the fibrous material being processed 5; the precompression device 12 is active on the compressible fibrous material ribbon to cause a predetermined compression of said ribbon before it comes to the rolling-up or packaging space 7.

[0031] In more detail, the precompression device 12 operates close to the conveyor belt 2 and is active on the fibrous material on the opposite side relative to the operating stretch 4a of said conveyor belt.

[0032] As shown in Figs. 1 and 2, the precompression device comprises at least one conveyor mat 13 having at least one portion 13a active on the fibrous material and exerting a compression action thereon, which action is directed perpendicularly to the feeding direc-

tion (see face 9) of the fibrous material towards the rolling-up space 7. More specifically, the conveyor mat 13 of the precompression device has a rectilinear active portion 13a converging towards the operating (rectilinear too) stretch 4a of the conveyor belt 2, as the ribbon moves closer to the rolling-up space 7.

[0033] Practically, an acute precompression angle α is formed between the active portion 13a of the conveyor mat 13 and the operating stretch 4a of the first conveyor belt 4, which angle fundamentally defines the percentage of maximum compression to be imparted to the material being processed.

[0034] In this connection it is to note that, if ribbon-like materials of different thicknesses (S1, S1) or different features in terms of compressibility are wished to be processed, movement means (not shown) adapted to angularly shift said mat so as to vary said precompression angle (α) may optionally be associated with the conveyor mat itself (see Fig. 2).

[0035] In order to carry out a compression action on the material being processed which is directed exclusively perpendicularly to the material itself without tangential stresses being exerted thereon, the active portion 13a of the precompression device 12 is moved at a peripheral speed V1 of contact with the material being processed having a component V1p parallel to the peripheral speed V2 of the operating stretch 4a of the conveyor belt 2 and of same modulus, direction and way as the speed V2 of stretch 4a. Clearly, for carrying out the desired compression, the peripheral speed V1p of the active portion 13a of the precompression device also has a component V1o orthogonal to the peripheral speed V2 of the operating stretch 4a of the first conveyor. This orthogonal component V1o will have a modulus to be fixed depending on requirements and in particular on opening of angle (α).

[0036] In all cases it is however essential that during feeding and compression of the material being processed the precompression device does not substantially exert any tangential action on the material to be packaged.

[0037] It is also to note that the movement means associated with the precompression device 12 can also include slides or similar devices for advantageously moving the device itself away from the rolling-up space 7, as the material is wound in a roll (see Fig. 1).

[0038] Practically, the movement means will be managed by a control unit for moving the precompression device 12 away from the packaging space and keep a minimum distance d between an outer perimetric edge 8a of the roll being packaged and the precompression device, constantly unchanged. It is to note that the first conveyor belt 2, the deflection belt 3 and the conveyor mat defining the precompression device can be activated by respective power units 14, 15, 16 or by a single power unit after interposition of kinematic connecting members, depending on the practical and construction requirements that are each time present.

[0039] At all events, the power unit or power units active on the conveyor belts and conveyor mat, suitably managed by a Central Processing Unit (CPU) 17, will be adapted to enable the peripheral speed of the different conveyors to be varied so as to obtain particular production rates or compression control effects in accordance with laws set in by the user during rolling up.

[0040] In operation, it is to note that the roller operating within the solid angle (Y) defined between the first and second conveyors is constantly guided in such a manner that it exhibit its rotation axis constantly disposed at the flat surface 18 bisecting the same above mentioned solid angle.

[0041] At all events, this roller can be counterbalanced by substantially exerting a constant compression action without particular and accurate electronic managements being required, because the compression control of the ribbon during rolling up substantially relies on the precompression device 12.

[0042] Finally, the apparatus in reference comprises at least one auxiliary unit 19 for feeding sheet material 20, which operates above the first conveyor belt 2, for example. Unit 19 is shiftable from a non-operating condition to an operating condition in which this auxiliary feeding unit is capable of sending a sheet material such as paper or plastic film, to the packaging station to carry out a final packaging of the fibrous-material roll, once the latter has reached the desired radial sizes.

[0043] The invention achieves important advantages.

[0044] First of all, due to the presence of the precompression device consisting of a conveyor mat the speed of which can be such managed, in terms of modulus and direction; that a mere compression action on the compressible material to be rolled up is exerted, said material is not submitted to any delamination action and can be packaged at high precompression values without any structural damage.

[0045] Obviously the above involves a perfect springing back of the fibrous material in use, so that it can offer improved heat insulation and soundproofing properties.

[0046] It is also to note that the apparatus in reference can be easily installed and fundamentally enables the whole compression action to be exerted upstream of the packaging space, an active and constant managing of the compression exerted by roller 6 operating between the first and second conveyor belts being substantially unnecessary.

[0047] In addition, since the compression action takes place on the material being not yet rolled up, this compression action does not give rise to any deformation in the shape of the roll 8 being formed, neither, during processing, does it modify the precompression already imparted to the rolled-up coils.

Claims

1. An apparatus for rolling up compressible fibrous materials, comprising:

- at least one conveyor member (2) having a corresponding operating stretch (2a) over which a ribbon of compressible fibrous material (5) to be packaged in the form of a roll (8) is placed;
 - at least one deflection member (3) cooperating with the conveyor member (2) and defining a solid angle (Y) of predetermined opening with said conveyor member (2);
 - at least one roller (6) operating at said solid angle (Y) between the conveyor member (2) and deflection member (3) so as to define, together with them, at least one rolling-up space (7) for the ribbon of compressible fibrous material, said conveyor member moving the ribbon of compressible fibrous material towards the rolling-up space in a predetermined feeding direction, characterized in that it comprises at least one precompression device (12) operating upstream of the rolling-up space (7) relative to the feeding direction, said precompression device being active on the compressible fibrous-material ribbon to cause a predetermined compression of said material before it reaches the rolling-up space (7).
2. An apparatus as claimed in claim 1, characterized in that the precompression device (12) operates at the conveyor member (2) and is active on the fibrous material (5), on the opposite side relative to the operating stretch (4a) of the conveyor member (2) itself.
 3. An apparatus as claimed in claim 2, characterized in that the precompression device (12) has at least one active portion (13a) operating on the fibrous material (5), which portion exerts on said material, a compression action directed perpendicularly to the predetermined feeding direction of the fibrous material towards the rolling-up space.
 4. An apparatus as claimed in anyone of the preceding claims, characterized in that the precompression device (12) comprises at least one conveyor mat (13), said one portion (13a) thereof active on the fibrous material being defined by a rectilinear stretch converging with said operating stretch (4a) of the conveyor member (2) as they move close to the rolling-up space, so as to cause a predetermined precompression of the fibrous material.
 5. An apparatus as claimed in claim 4, characterized in that the conveyor member (2) comprises at least one conveyor surface having an operating stretch (4a) of rectilinear conformation inclined by an acute precompression angle (α) relative to said active portion (13a).
 6. An apparatus as claimed in claim 4, characterized in that the active portion (13a) of the precompression device has a peripheral speed (V1) having a component (V1p) parallel to a peripheral speed (V2) of the operating stretch (4a) of the conveyor member (2), and a component (V1o) perpendicular to the peripheral speed (V2) of the operating stretch (4a) of the first conveyor, said parallel component (V1p) substantially being of same modulus, direction and way as the peripheral speed (V2) of the first operating stretch (4a) of the conveyor member (2).
 7. An apparatus as claimed in claim 1, characterized in that it comprises movement means operatively associated with the precompression device (12) to move the latter close to and away from said rolling-up space (7) for roll formation.
 8. An apparatus as claimed in claim 7, characterized in that the movement means comprises slides for carrying out a translation parallelly of said feeding direction.
 9. An apparatus as claimed in claim 1, characterized in that it comprises movement means operatively acting on the precompression device (12) for angularly moving said device (12) and varying said precompression angle (α).
 10. An apparatus as claimed in claim 7, characterized in that it comprises a control unit active on the movement means for progressively moving the precompression device (12) away from the rolling-up space, as the material is rolled up.
 11. An apparatus as claimed in claim 10, characterized in that the control unit and movement means cooperate together for moving the precompression device away from the rolling-up space (7) and keeping a distance (d) between a perimetric edge (8a) of the roll and the precompression device (12), constantly unchanged.
 12. An apparatus as claimed in claim 3, characterized in that it comprises a power unit for setting the active portion (13a) of the conveyor mat in motion at a predetermined peripheral speed, susceptible of being varied upon command of a control unit active on the power unit itself.
 13. An apparatus as claimed in claim 1, characterized in that said roller (6) is radially shiftable relative to the roll being formed and has a rotation axis (11) constantly disposed at a flat surface (18) bisecting said solid angle (Y).
 14. An apparatus as claimed in claim 1 or claim 13,

characterized in that said roller (6) is an idler roller and exerts a substantially constant pressure on the roll being formed.

15. An apparatus as claimed in claim 1, characterized 5
in that it comprises at least one auxiliary unit (19)
for feeding sheet material (20) in order to carry out
a final packaging of the rolled-up material.

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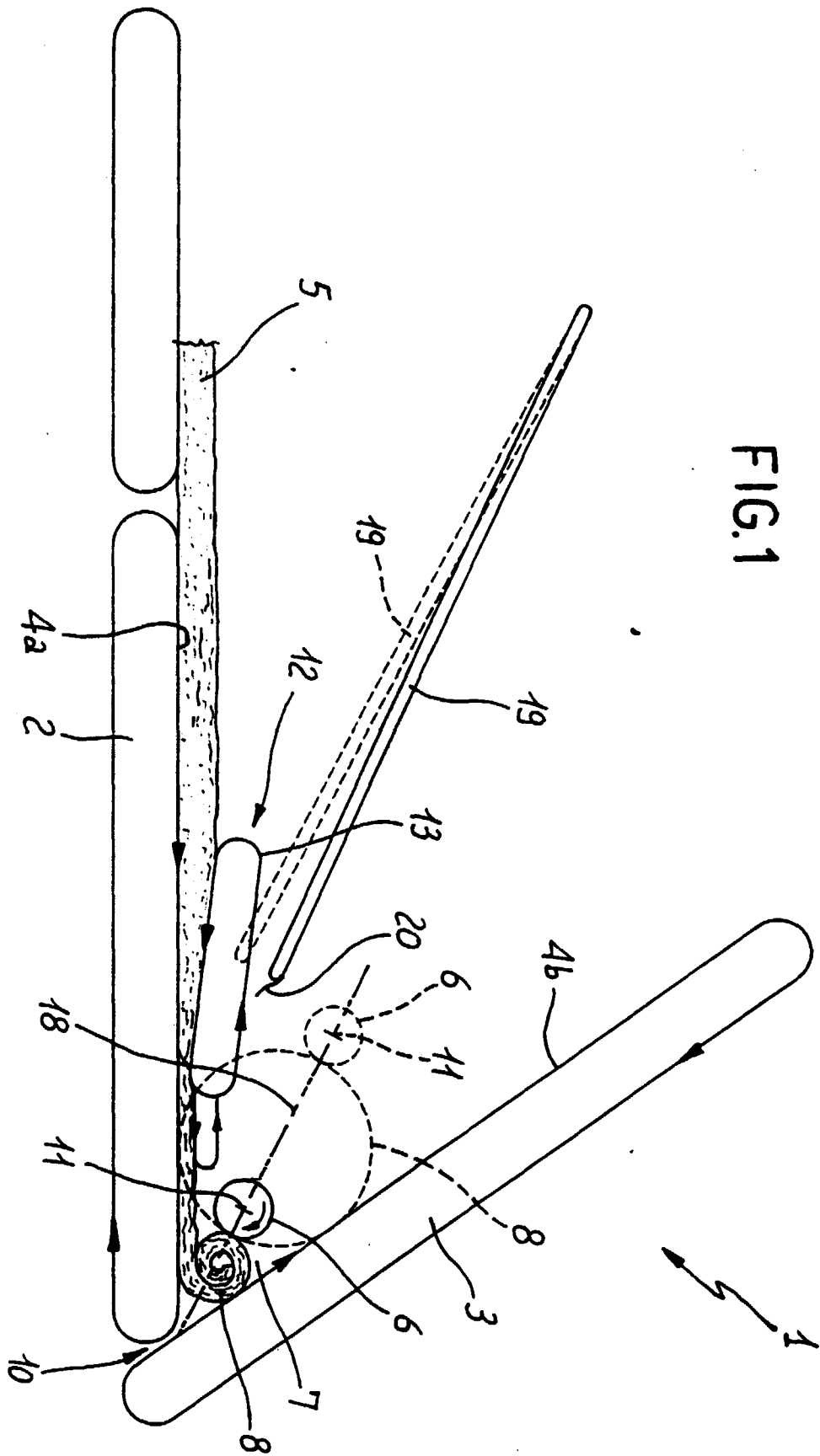
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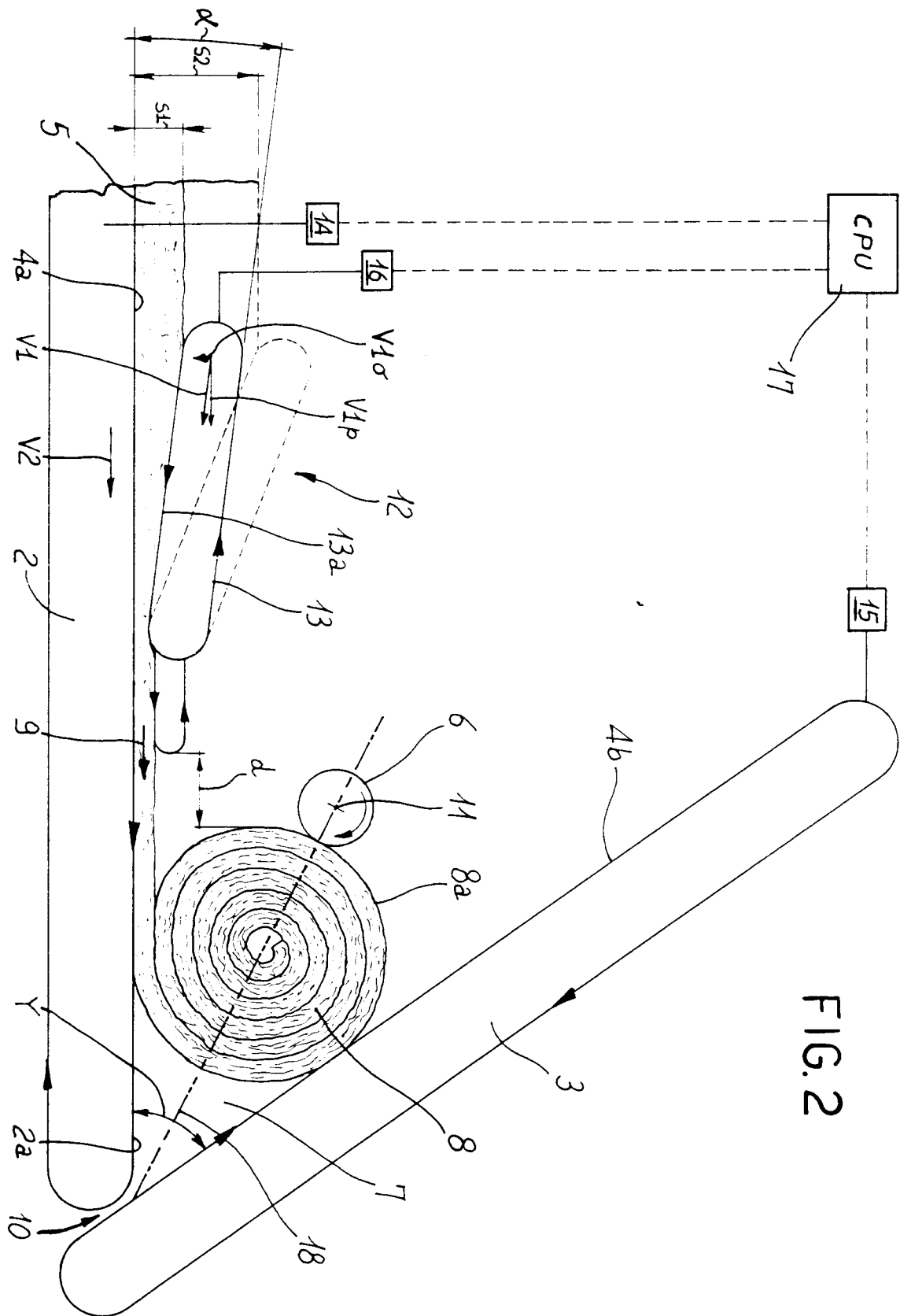
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European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0127

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	EP 0 734 985 A (TICTOR SA) 2 October 1996 * column 6, line 1 - line 11 * * column 6, line 55 - column 7, line 7; claim 3; figure 2 * ---	1-12,14 13,15	B65H1/00 B65H18/22 B65H19/22
D,A	EP 0 140 785 A (SAINT GOBAIN ISOVER) 8 May 1985 * the whole document * ---	1-15	
A	US 4 602 471 A (GRAY WILLIAM E ET AL) 29 July 1986 * the whole document * ---	1-15	
A	DE 296 04 901 U (KAIBEL & SIEBER GMBH) 15 May 1996 * the whole document * -----	1-15	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B65H B65B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		13 August 1998	Haaken, W
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			