



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.10.2018 Bulletin 2018/41

(51) Int Cl.:
E06B 9/42 (2006.01) D03D 15/08 (2006.01)

(21) Application number: **18166098.6**

(22) Date of filing: **06.04.2018**

(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
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **VKR Holding A/S**
2970 Hørsholm (DK)

(72) Inventor: **Nielsen, Casper Grønvig**
5000 Odense (DK)

(74) Representative: **AWA Denmark A/S**
Strandgade 56
1401 Copenhagen K (DK)

(30) Priority: **06.04.2017 DK PA201770250**

(54) **SCREENING ARRANGEMENT WITH EXTENSIBLE SCREEN AND METHOD FOR PROVIDING VARIABLE SCREENING OF A WINDOW**

(57) The screening arrangement (100) provides for adjustment of the light intake of a window, by providing an extensible screen (6) with variable permeability such that when traction is applied, the permeability of the material is increased. A roller shaft (1) is connected to drive means and traction means are provided to apply a traction force on the extensible screen (6) to bring the extensible screen (6) to a first stretched state in which the permeability of the material is increased, corresponding to a first screening position. From the first screening position, the extensible screen (6) is brought to a second screening position in which the extensible screen (6) is in a second stretched state by continued rotation of the roller shaft (1) in the unwinding direction. The permeability of the extensible screen (6) is decreased in the second stretched state relative to the first stretched state. According to the invention, the traction means comprises a cord system including at least one traction cord (3) in connection with the roller shaft (1) and the extensible screen (6). A spring device (5) provides pretensioning of the traction cord (3), the cord system being configured to apply a traction force on the extensible screen (6) such that the tension exerted by the cord system on the extensible screen (6) provides said first stretched state during unwinding of the extensible screen (6).

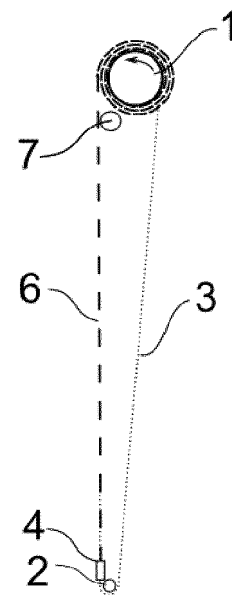


Fig. 3b

Description

Technical Field

[0001] The present invention relates to a screening arrangement for adjusting the light intake of a window and comprising an extensible screen. The invention furthermore relates to a method for providing variable screening of a window.

Background Art

[0002] Screening arrangements positioned in front of a window to cover the window from direct sunlight in the screening position are common. Usually such a screening arrangement comprises a screen in the form of a blind or shade, such as a roller blind or a pleated blind. A roller blind is typically comprised of a flexible screen, typically made of fabric, arranged on a roller shaft. The fabric used can be of varying quality depending on the purpose. For instance, the fabric may be a light fabric, which allows a generous amount of light into the room. The fabric can otherwise be a thick fabric with a light impermeable coating to ensure a dark room. The problem with this type of roller blind is that it is difficult to adjust the amount of light. The only way to adjust the light intake is to vary the covering length of the blind. In the prior art, several attempts have been made in order to alleviate this problem.

[0003] One example is described in US2015/0191971 A1 which describes a screening arrangement of the kind mentioned in the introduction. In this arrangement, the screen comprises an elastic fabric provided with apertures. The screen is wound on a winding tube driven by a motor, and can be deployed to a length corresponding to the window. In the most simple embodiments, the load bar at the lower end edge of the screen is fixed in position relative to a stationary bolt or support at the lower end of the window, following which the screen is subjected to either a traction to widen the apertures, or relaxed to close the apertures. In a more developed embodiment, an arrangement of the kind mentioned in the introduction is devised, in which the arrangement is provided with tensioning means in the form of two winding tubes. In one embodiment, the traction on the screen ensuring increased permeability during the unwinding of the screen is provided by the weight of the load bar. Obviously, this arrangement is dependent on partly a sufficient weight of the load bar, partly on the installation position as the arrangement is only suitable in installations in which the gravity acts entirely, or at least mostly, in the direction. Hence, this screening arrangement is unsuitable for screening windows installed either horizontally or obliquely, for instance roof windows installed in an inclined roof.

Summary of Invention

[0004] With this background it is the object of the in-

vention to provide a screening arrangement, which may be utilised in a wide variety of installation positions and which provides for improved operating conditions.

[0005] In a first aspect, this and further objects are met by a screening arrangement of the kind mentioned in the introduction, which is furthermore characterized in that the traction means comprises a cord system including at least one traction cord having a first end in connection with the roller shaft and a second end in connection with the second end portion of the extensible screen, and a spring device to provide pre-tensioning of the at least one traction cord, the cord system being configured to apply a traction force on the extensible screen such that the tension exerted by the cord system on the extensible screen provides said first stretched state during unwinding of the extensible screen.

[0006] In this manner, a screening arrangement is provided which can be used in a wide range of windows, including windows installed in an inclined roof surface, or even horizontally. The control of the degree of permeability of the extensible screen is improved as well.

[0007] The terms permeability, permeable etc. as used herein are to be interpreted as encompassing transmission of light and heat from one side of the screening arrangement to the other. Permeability thus encompasses light permeability, including transparency and translucency, but also the ability to allow heat transfer from the inside to the outside, or vice versa.

[0008] In one preferred embodiment, a bottom bar is connected to the second end portion of the extensible screen. In addition to achieving a suitable element for operation, including the provision of for instance solar cells to acquire power for operation, this also opens up to the possibility of accommodating the spring device in the bottom bar.

[0009] In one alternative embodiment, the spring device is provided behind a header and/or side rails of the screening arrangement. In a further development of this development, the spring device is provided behind the side rail and comprises a first, movable pulley, a second pulley fixed to a stationary part of the screening arrangement, a third pulley fixed to a stationary part of the screening arrangement, and a tension spring connected at one end to a stationary part of the screening arrangement at a fixed connection point and at the other end to a movable connection point coupled to the first pulley, the second end of each traction cord being guided around the first pulley, the second pulley and the third pulley and further to the bottom bar of the screening arrangement.

[0010] In another alternative, or additional, embodiment the spring device comprises forming at least one traction cord with at least one elastic portion.

[0011] Common to the above-mentioned embodiments is that the spring device provides a "cord reserve" ensuring proper functioning of the screening arrangement in that the pre-tensioning of the cord system makes it possible to accommodate a surplus length of each traction cord when the extensible screen is brought from the

first stretched state to the second stretched state. Once the extensible screen is brought back from the second stretched state, the cord reserve is again released.

[0012] In a second aspect, a method for providing variable screening is provided as defined in independent claim 21.

[0013] The pre-tensioning of the cord system may in principle be configured in relation to the driving torque and rotational speed on the roller shaft according to any suitable interrelationship which provides for the desired tension in the first and the second stretched state. In one presently preferred embodiment the pre-tensioning of the cord system is interrelated to the rotation of the roller shaft during the movement from the non-screening position via the first screening position to the second screening position, such that:

- a. the tension in the extensible screen exceeds the tension of the cord system during the movement from the non-screening position to the first screening position; and
- b. the tension in the extensible screen is lower than the tension in the cord system in the second screening position.

[0014] The advantages of the second aspect of the invention and further developed embodiments also applicable to the second aspect of the invention have been described in the above and reference is made thereto.

[0015] Further details are described, and further advantages stated, in the description of particular embodiments of the invention.

Brief Description of Drawings

[0016] In the following the invention will be described in further detail by means of examples of embodiments with reference to the schematic drawings, in which

Fig. 1 is a perspective view of a screening arrangement in an embodiment of the invention;

Fig. 1a is a perspective view of a screening arrangement in another embodiment of the invention, mounted on a window;

Fig. 2 is a perspective view of a screening arrangement in an embodiment of the invention;

Figs 3a to 3d are schematic side views illustrating the operation of a screening arrangement in an embodiment of the invention in four different conditions; Fig. 4 is a graph showing the relative tension in the extensible screen and the spring device in the four conditions shown in Figs 3a to 3d;

Figs 5a and 5b are partial front views illustrating the material of a screening arrangement in an embodiment of the invention, in a stretched and a relaxed condition, respectively;

Fig. 6 is a detail view of a screening arrangement in an embodiment of the invention;

Fig. 7a is a front view of details of a screening arrangement in another embodiment of the invention; and

Fig. 7b is a partial side view, on a larger scale, of parts of the embodiment shown in Fig. 7a.

Description of Embodiments

[0017] In the following, embodiments of the first and the second aspects will be described in further detail. Figs 1 to 3 schematically illustrate embodiments of a screening arrangement 100 adapted to be arranged in a window 150. The window will be referred to only as "window" and the invention is in particular intended for use in a roof window, installed in an inclined roof surface. Directional terms such as "upper", "lower" etc. relate to the position shown in the drawings. The invention is in principle applicable to all types of windows for installation in all types of roofs, including flat roofs, and facades, however. The window has, in a manner known per se, at least one frame encasing a window opening to be screened. In the embodiment shown in Fig. 1a, a stationary frame 151 is configured to be installed in a roof surface, and an openable frame in the form of a sash 152 is connected to the frame 151 by means of a set of hinges (not shown in detail). Elements having the same or analogous function are denoted by the same reference numerals throughout.

[0018] Referring now in particular to Fig. 2, the screening arrangement 100 comprises an extensible screen 6 and has a predefined length between a first end portion 61 and a second end section 62, and is made from a material having variable properties as regards permeability, including transparency, as will be described in further detail in the following. Terms such as permeability, light permeability, transparency, light intake etc. are used interchangeably in the following, and even though the terms are used in connection with light transmission from the outside to the inside in the description of the embodiments, these terms do not preclude that the permeability also includes light transmission from the inside to the outside and heat transfer from the outside or in, or vice versa.

[0019] The first end portion 61 is connected to a roller shaft 1 connected to drive means (not shown) such that the extensible screen 6 may be wound up on and unwound from the roller shaft 1 under rotation thereof. The extensible screen 6 is typically rectangular, and the width of the extensible screen corresponds to or is slightly smaller than the length of the roller shaft. This may however be different depending on the specific installation, the width being defined between opposed side portions 63, 64. The roller shaft 1 is typically positioned at the top of the window, for instance fastened by suitable brackets to one of the frames of the window. Most commonly the roller shaft 1 is arranged horizontally at the top of the window. This is however not limiting for the screening arrangement 100 which may be suitably used in any di-

rection depending on the size and shape of the window. The extensible screen 6 may thus be brought from a non-screening position in which the extensible screen 6 is wound more or less completely on to the roller shaft 1 and to one or more screening positions by moving the second end portion 62 downwards, hence typically in the direction towards the bottom of the window, as will be elaborated on below.

[0020] In the embodiment shown in Fig. 1, the screening arrangement 100 comprises a header 9 arranged to cover at least the roller shaft 1 at the top of the window and two side rails 10 in which the side portions 63, 64 of the extensible screen 6 are guided. Furthermore, the screening arrangement 100 comprises a bottom bar 4 connected to the free or second end portion 62 of the extensible screen 6.

[0021] In the embodiment of Fig. 1a, the screening arrangement is provided in the form of an external awning in which the screen 6 in the non-screening position is accommodated in a top element forming the header 9 and connected to the top piece of the stationary frame 151. Side rails 10 guiding the side portions of the screen 6 and the bottom bar 4 are connected to the header 9. The side rails 10 are slidably connected to the bottom piece of the sash 152 in a manner known per se.

[0022] In order to obtain the variable permeability, the extensible screen 6 may in general be formed by any material such as textile made with at least one of elastic, lamellae, knits, pleat, non-woven or the like, in which a plurality of openings or apertures 8 are able to form. In addition to distinct apertures, such apertures may also be provided as interstices in a mesh, as indicated schematically in the embodiments of Figs 1, 1a and 2, and the term "apertures" will be adhered to in the following. Referring now also to Figs 5a and 5b, the variation of the permeability of the extensible screen 6 is shown: From a stretched length L in which the apertures 8 have a height h, the extensible screen 6 is able to be relaxed to a relaxed length L2 in which the apertures 8 have a relaxed height h2. That is, a traction force applied to the material in the direction of arrows A in Fig. 1, i.e. in a first direction, may stretch or extend the material in order to widen apertures 8 that may vary in size depending on the size of the traction force. The first direction here corresponds to a height direction of the screening arrangement 100 as depicted in Fig. 1; in general, the first direction corresponds to the winding and unwinding directions. In an unstretched, or substantially relaxed, state, the apertures 8 barely show, and hence there is little permeability. In a stretched state, the apertures 8 are increased in size in at least the first direction, and thereby light intake from a window can be varied.

[0023] An example of a fabric with apertures is described in WO 2011 /150902 A1 in which the fabric or textile is elastic in a first direction and is substantially inelastic in a second direction and wherein apertures, the size of which can be controlled according to the elasticity of the fabric, are formed in the fabric or textile when the

textile is stretched in the direction in which the textile is elastic. When used in the extensible screen 6 of the present invention, the fabric will have the properties indicated in Figs 5a and 5b, as the fabric is formed as a warp, having a plurality of warp threads of elastic fibres or yarns and weft yarns Y added by conventional joining techniques and typically designed as threads arranged in pairs, one behind the other. The weft yarns are substantially non-elastic, so that the screen, so that the screen may be stretched in the longitudinal direction, that is in the direction of the warp yarns, that is from the length L2 to the length L, without significantly shrinking in the transverse direction, i.e. in the direction of the weft yarns, where the dimension B in the width dimension is substantially constant.

[0024] Additional means may also be provided to keep the extensible screen substantially inextensible in a direction substantially perpendicular to said first direction, such that when traction is exerted on the screen in the first direction, the dimension B in the second direction is substantially unchanged. Furthermore, there may also be provided means that limit the extension of the extensible screen in the first direction. These means may inherent in the fabric used in the extensible screen, or be provided as separate elements.

[0025] In order to provide the traction force to vary the transparency, or light permeability, of the extensible screen 6, the screening arrangement 100 comprises traction means which is operated to bring the screening arrangement from a first screening position to a second screening position, and vice versa.

[0026] In general, it is noted that the traction means is configured to maintain the extensible screen 6 in the first stretched state during unwinding of the extensible screen 6 until the well-defined end stop has been reached, corresponding to a first screening position, and in which the extensible screen 6 is brought to a second screening position in which the extensible screen 6 is in a second stretched state. This is carried out by continued rotation of the roller shaft 1 in the unwinding direction, and the permeability of the extensible screen 6 is decreased in the second stretched state relative to the first stretched state.

[0027] It is now referred to Fig. 2 showing the details of the screening arrangement 100 in one embodiment, the bottom bar 4 being indicated only schematically for reasons of clarity.

[0028] The traction means comprises a cord system including at least one traction cord 3 having a first end 3a in connection with the roller shaft 1 and a second end 3b in connection with the second end portion 62 of the extensible screen 6, and a spring device 5 to provide pre-tensioning of the at least one traction cord 3. The cord system is configured to apply a traction force on the extensible screen 6 such that the tension exerted by the cord system on the extensible screen 6 provides said first stretched state during unwinding of the extensible screen 6. The position of the roller shaft 1 is denoted by

axis X1. In the embodiment shown, the cord system comprises two traction cords 3, each being associated to a respective spring device 5. By having two traction cords 3, the load is more evenly distributed.

[0029] In the embodiment shown, each spring device 5 is positioned within the confines of the bottom bar 4 and comprises a tension spring directly connected to the second end 3b of the traction cord 3, but other arrangements are conceivable. Other configurations of such a spring device to provide pre-tensioning of the traction cord or cords include the provision of a spring device placed behind the header and/or side rails, and by forming the traction cord or cords at least partially by elastic portions. It is noted that the term "pre-tensioning" is to be interpreted as encompassing any configurations of the cord system which allows the traction cord or cords to be kept tight at all times, and which is able to provide a "cord reserve" which serves partly to compensate for the differences in wound up length of the traction cord(s) relative to the unwound length of extensible screen during unwinding, partly to accommodate a surplus length of the traction cord(s) when the extensible screen is brought from the first stretched state to the second stretched state.

[0030] In the embodiment shown in Fig. 2, each traction cord 3 is connected to the second end portion 62 of the extensible screen 6 via the bottom bar 4 and to the roller shaft 1 in that a first end 3a is wound onto the roller shaft 1, here in the opposite direction of the winding of the extensible screen 6. Alternatively to connecting the traction cords 3 directly to the roller shaft 1 as shown, the winding of the traction cords may also be provided on a separate winding reel. The winding reel may be connected directly to the roller shaft or via a suitable transmission mechanism such as a belt drive or a chain drive.

[0031] Referring still to Fig. 2, the screening arrangement 100 further comprises at least one idler shaft or pulley 2, here two pulleys 2, one positioned at either side of the extensible screen 6 along an axis X2 to cooperate with a respective traction cord 3. As an alternative to rotatable pulleys, a fixed pin with a low friction surface may be used. The pulleys 2 are arranged substantially parallel to and at a distance from the roller shaft 1, each traction cord 3 being guided around the respective pulley 2 such that the respective traction cord 3 forms a loop between the roller shaft 1 and the second end portion 62 of the extensible screen 6, either directly to the second end portion or via the bottom bar 4. In the embodiment shown, the pulleys 2 are located near the end point for the travel of the extensible screen 6.

[0032] Referring now to Figs 3a to 3d, the operation of the screening arrangement 100 will be described in further detail, i.e. bringing the extensible screen 6 from an unwound, non-screening position via a first screening position to a second screening position. Only parts of the screening arrangement relevant to describing the principles of operation are shown in these Figures. Elements having the same or analogous function as in the embod-

iments of Figs 1 and 2 are denoted by the same reference numerals throughout. Also shown is a positioning element comprising an optional guide roller 7, having a positioning surface arranged to position the extensible screen 6 in the predefined screening plane in those case in which a desired screening plane is defined in the deployed position.

[0033] Generally, the wound up position is when the extensible screen 6 is fully withdrawn and the entirety of the window opening to be screened is exposed, i.e. a non-screening position. To compare, the deployed position is when the extensible screen 6 is unwound and deployed to cover the entire window opening in a first screening position. As will be described in further detail below, the extensible screen 6 is furthermore adapted to assume a second screening position, in which the material of the extensible screen 6 is in a second stretched state and is stretched to a reduced level relative to the first stretched state and the apertures 8 are in a more closed condition.

[0034] In Fig. 3a, a partially unwound extensible screen 6 is shown. In order to unwind the extensible screen 6, the roller shaft 1 is rotated in a first rotational direction (counter-clockwise in the embodiment shown) and the extensible screen 6 moves downwards. During unwinding of the extensible screen 6 from the wound up non-screening position to the fully deployed position of the first screening position, the bottom bar 4 may also be positioned in a number of intermediate positions in between to provide a variety of screening positions. During this movement, the extensible screen 6 is in a first stretched state, as indicated schematically by the relatively large distance between the dashes. Furthermore, the traction cords 3 are wound onto the roller shaft 1 during the unwinding of the screen 6.

[0035] In the first screening position shown in Fig. 3b, the extensible screen 6 is deployed, i.e. unwound from the roller shaft 1, and the extensible screen 6 is in a first stretched state. The position of the second end portion 62 of the extensible screen, or of the bottom bar 4, relative to the window opening to be screened is in a well-defined end point, which may be mechanically defined, for instance by an abutment, or controlled electronically by suitable programming of the drive means.

[0036] The roller shaft 1 may receive its driving torque to unwind and wind up the extensible screen 6 from a motor. Although not described in further detail, the drive means of the embodiment of Fig. 2 comprises a tubular motor incorporated in the roller shaft 1, but may also be positioned externally of the roller shaft, in mechanical connection with the roller shaft. The tubular motor is connected to a control system including calibration means such as a revolution counter and/or one or more sensors. The motor may thus be configured to provide the screening arrangement 100 with a suitable torque at a suitable speed over predefined time periods. The drive means of the screening arrangement is typically calibrated, for instance by a revolution counter, in order to detect the de-

played position. On the basis of the calibration, the extent of the desired stretch of the extensible screen 6 is able to be determined and programmed into the control means. One simple manner of achieving the well-defined end point is by programming the control means to detect an increase in the power consumption of the tubular motor.

[0037] As indicated in Fig. 3b, the extensible screen 6 is in a first stretched state in this first screening position which substantially corresponds to the level of tension during unwinding, i.e. in Fig. 3a. Fig. 4 illustrates the relative magnitudes of the tensional forces in the cloth of the extensible screen 6 and the cord system/spring device, respectively, at the positions indicated in Figs 3a to 3d. Thus, as shown in Fig. 4, at the positions "3a" and "3b", indicating schematically that during the unwinding, the pre-tensioning of the cord system is interrelated to the rotation of the roller shaft 1 during the movement from the non-screening position via the first screening position to the second screening position, such that the tension in the extensible screen 6 exceeds the tension of the cord system during the movement from the non-screening position to the first screening position.

[0038] Fig. 3c illustrates a second screening position, which has been reached following a continuing rotation of the roller shaft 1 in the first rotational direction, i.e. to unwind the extensible screen 6 further to reach a second stretched state. Referring to Fig. 4, position "3c", it is noted that the tension in the extensible screen 6 is lower than the tension in the cord system in this second screening position. This results in the permeability of the extensible screen 6 being lower than in the first screening position, thus attaining a darkening effect.

[0039] The roller shaft 1 may then be rotated even further to allow the extensible screen 6 to attain the position shown in Fig. 3d, in which the extensible screen 6 is substantially completely relaxed, such that a minimum permeability is obtained. The relationship between the tension in the screen 6 and the cord system including the spring device is illustrated in Fig. 4, position "3d".

[0040] The level of tension of the cord system relative to the tension of the extensible screen in the second screening position shown in Fig. 3c, and the amount of screening material of the extensible screen 6 remaining on the roller shaft 1 to allow further rotation and a completely relaxed condition as in Fig. 3d is of course dependent on the predefined length of the extensible screen 6 as defined between the first end portion 61 and the second end portion 62. By definition, this predefined length corresponds to a completely relaxed state of the extensible screen 6. It is possible to configure the predefined length of the extensible screen 6 to be smaller than the height of the window, thus resulting in the possibility of having a tension of the extensible screen when the screen is completely unwound and hence also in the second stretched state, corresponding to the second screening position. In case it is desirable to achieve a completely relaxed state of the extensible screen, the

predefined length of the extensible screen 6 may alternatively be configured relative to the height of the window opening to be screened as one of the following options:

- 5 i. the predefined length exceeds the height of the window opening to such an extent that the extensible screen 6 is substantially relaxed in the second screening position; or
- 10 ii. the predefined length exceeds the height of the window opening to such an extent that the extensible screen 6 is relaxed and a portion of the extensible screen 6 other than the first end portion 61 remains on the roller shaft 1 in the first screening position.

15 **[0041]** In situations i. and ii., it is however also advantageous that there is still a slight amount of tension in the extensible screen 6 in order to avoid undesirable hanging of the cloth of the extensible screen 6. This may be obtained by suitable control of the rotation of the roller shaft 1.

20 **[0042]** It is also conceivable to configure the maximum stretched length of the extensible screen in accordance with the predefined length and/or the height of the window opening to be screened. Among other things, the maximum stretched length may be of use in defining the relationship between the first and second stretched state, but also in the dimensioning of for instance the header of the screening arrangement in accordance with the cloth thickness of the extensible screen. Preferably, the ratio between the maximum stretched length and the predefined length of the extensible screen 6 lies in the range 1.2 to 2.0, preferably 1.3 to 1.7, even more preferably about 1.5.

25 **[0043]** The relationship between the torque provided by drive means on the roller shaft and the force which the traction cords 3 influence the bottom bar 4 depends on several factors including the dimensioning of the roller shaft 1, the elasticity, thickness and predefined length of the extensible screen 6, of whether the traction cords 3 are wound up on a separate winding reel or on the roller shaft 1 itself, and if so, on a part of reduced diameter thereof; and last but not least the configuration and dimensioning of the spring device acting to provide a pre-tensioning of the traction cords 3.

30 **[0044]** The cord system is operable to provide a "cord reserve" inherent in the spring device 5 to ensure proper functioning of the screening arrangement 100. The pre-tensioning of the cord system provides for a cord reserve such that a surplus length of the traction cord or cords 3 is accommodated when the extensible screen 6 is brought from the first stretched state to the second stretched state. This cord reserve is then again released when the extensible screen 6 is to be brought back to its collapsed position by rotating the roller shaft 1 is subsequently rotated in a second rotational direction (clockwise in the embodiment shown), opposite to the first rotational direction shown in Figs 3a to 3d, and thus returns the extensible screen 6 on to the roller shaft 1. The roller

shaft 1 is then set to rotate further in the second rotational direction. The traction cords 3 will at the same pace unwind from the roller shaft 1 and follow the path of the extensible screen 6 until the extensible screen 6 is in a wound up position.

[0045] The provision of a suitable pretension of the cord system, and a corresponding amount of the inherent cord reserve, is well within the skills of the person skilled in the art. It is also conceivable to provide this "cord reserve" in alternative embodiments, for instance by a spring device arranged behind the side rail and connected to the traction cord as will be described below in connection with the embodiment of Figs 7a and 7b, or by forming the traction cord partly or entirely from elastic portions. In this regard, it is noted that the specific embodiment shown in Fig. 6 is preferred, in which the suspension of the second end 3b of the traction cord 3 is provided by the spring device of the cord system. The bottom bar 4 in Fig. 6 accommodates the second end 3b of the traction cord 3 arranged in connection with the spring device 5 comprising a spring-loaded pulley 11 of which the spring-load is provided by a pressure spring, and the second end 3b of the cord is guided about a guide pulley 12. This spring device 5 provides a more even traction force and reduces the impulse force on the cord and thereby in turn the extensible screen 6 during winding and unwinding, in addition to being of a compact design and to the compensation properties described in the above. Alternatively or additionally, the tubular motor of the roller shaft 1 may be provided with torsion spring reels.

[0046] Referring now to Figs 7a and 7b, an alternative embodiment is shown in which the spring device 50 is provided behind the side rail 10 (as in Fig. 1). One spring device 50 may be provided behind each side rail 10 of the screening arrangement 100. Elements having the same or analogous function are denoted by the same reference numerals as in the description of the above embodiments. The spring device 50 comprises a first, movable pulley 51, a second pulley 52 fixed to a stationary part of the screening arrangement 100, a third pulley 53 fixed to a stationary part of the screening arrangement 100, and a tension spring 54 connected at one end to a stationary part of the screening arrangement at a fixed connection point 55 and at the other end to a movable connection point 56 coupled to the first pulley 51. The stationary part of the screening arrangement 100 may for instance be the side rail 10 itself, or a supplemental element connected to for instance the header 9. A further detail shown in Fig. 7b is a link 57 coupling the movable connection point 56 to the first, movable pulley 51. The second end 3b of each traction cord 3 is guided around the first pulley 51, the second pulley 52 and the third pulley 53 and further to the bottom bar 4 of the screening arrangement 100. In this way, the extensible screen 6 is kept under sufficient tension by the spring device 50, while at the same time providing the cord reserve to be accommodated and again released during operation of

the screening arrangement 100.

[0047] The invention should not be regarded as being limited to the described embodiments. Several modifications and combinations of the different embodiments will be apparent to the person skilled in the art.

List of reference numerals

[0048]

100	screening arrangement
1	roller shaft
2	pulleys
3	traction cord
3a	first end
3b	second end
4	bottom bar
5	spring device
6	extensible screen
61	first end portion
62	second end portion
63, 64	side portions
7	guide roller
8	apertures
9	header
10	side rails
11	spring-loaded pulley
12	guide pulley
50	spring device
51	first pulley
52	second pulley
53	third pulley
54	spring
55	fixed connection point
56	movable connection point
57	link
150	window
151	frame
152	sash
X1	axis
X2	axis
A	arrows
B	width dimension
L	stretched length
L2	relaxed length
h	stretched height of apertures
h2	relaxed height of apertures

Claims

1. A screening arrangement (100) for adjusting the light intake of a window and comprising:

an extensible screen (6) having a predefined length between a first end portion (61) and a second end portion (62), the extensible screen (6) being made from a material with variable permeability in at least a first direction such that when traction is applied to the material in said first direction, the permeability of the material is increased, the extensible screen (6) defining a maximum stretched length,

a roller shaft (1) connected to drive means, the first end portion (61) of the extensible screen (6) being connected to the roller shaft (1), the extensible screen (6) being wound on the roller shaft (1) in a non-screening position and configured to be unwound from the roller shaft (1) under rotation of the roller shaft (1) in an unwinding direction, to a deployed position at a well-defined end stop, and

traction means configured to apply a traction force on the extensible screen (6) to bring the extensible screen (6) to a first stretched state in which the permeability of the material is increased,

in which the traction means is configured to maintain the extensible screen (6) in the first stretched state during unwinding of the extensible screen (6) until the well-defined end stop has been reached, corresponding to a first screening position, and in which the extensible screen (6) is brought to a second screening position in which the extensible screen (6) is in a second stretched state by continued rotation of the roller shaft (1) in the unwinding direction, the permeability of the extensible screen (6) being decreased in said second stretched state relative to said first stretched state,

characterised in that

the traction means comprises a cord system including at least one traction cord (3) having a first end (3a) in connection with the roller shaft (1) and a second end (3b) in connection with the second end portion (62) of the extensible screen (6), and a spring device (5; 50) to provide pre-tensioning of the at least one traction cord (3), the cord system being configured to apply a traction force on the extensible screen (6) such that the tension exerted by the cord system on the extensible screen (6) provides said first stretched state during unwinding of the extensible screen (6).

2. A screening arrangement according to claim 1, wherein the cord system comprises two traction

cords (3), each traction cord (3) being associated to a respective spring device (5).

3. A screening arrangement according to claim 1 or 2, wherein the predefined length of the extensible screen (6) between the first end portion (61) and the second end portion (62) corresponds to a completely relaxed state of the extensible screen (6), and wherein the predefined length of the extensible screen (6) is configured relative to the height of the window opening to be screened as one of the following options:

- i. the predefined length exceeds the height of the window opening to such an extent that the extensible screen (6) is substantially relaxed in the second screening position; or
- ii. the predefined length exceeds the height of the window opening to such an extent that the extensible screen (6) is relaxed and a portion of the extensible screen (6) other than the first end portion (61) remains on the roller shaft (1) in the first screening position.

4. A screening arrangement according to any one of the preceding claims, wherein the ratio between the maximum stretched length and said predefined length of the extensible screen (6) lies in the range 1.2 to 2.0, preferably 1.3 to 1.7, even more preferably about 1.5.

5. A screening arrangement according to any one of the preceding claims, wherein a bottom bar (4) is connected to the second end portion (62) of the extensible screen (6).

6. A screening arrangement according to any one of the preceding claims, wherein the first end (3a) of each traction cord (3) is connected directly to the roller shaft (1).

7. A screening arrangement according to any one of claims 5 and 6, wherein the second end (3b) of the traction cord (3) is connected to the bottom bar (4).

8. A screening arrangement according to any one of claims 1 to 5, wherein each traction cord is in connection with the roller shaft via a winding reel, said winding reel being preferably connected to the roller shaft via a transmission mechanism such as a belt drive or a chain drive.

9. A screening arrangement according to any one of the preceding claims, further comprising at least one idler shaft or pulley (2) arranged substantially parallel to and at a distance from the roller shaft (1), each traction cord (3) being guided around the respective idler shaft or pulley (2) such that the respective trac-

tion cord (3) forms a loop between the roller shaft (1) and the second end portion (62) of the extensible screen (6) or bottom bar (4).

10. A screening arrangement according to any one of the preceding claims, wherein a header (9) is arranged to cover at least the roller shaft (1) at the top of the window, and side rails (10), in which side portions (63, 64) of the extensible screen (6) is guided. 5
11. A screening arrangement according to any one of claims 5 to 8, wherein the spring device (5) is accommodated in the bottom bar (4) and the second end (3b) of each traction cord (3) is connected to the spring device (5), preferably via a spring-loaded pulley (11) and a guide pulley (12). 10
12. A screening arrangement according to any one of claims 5 to 8, wherein the spring device (50) is provided behind the header and/or the side rails. 15
13. A screening arrangement according to claim 12, wherein the spring device (50) is provided behind the side rail (10) and comprises a first, movable pulley (51), a second pulley (52) fixed to a stationary part of the screening arrangement (100), a third pulley (53) fixed to a stationary part of the screening arrangement (100), and a tension spring (54) connected at one end to a stationary part of the screening arrangement at a fixed connection point (55) and at the other end to a movable connection point (56) coupled to the first pulley (51), the second end (3b) of each traction cord (3) being guided around the first pulley (51), the second pulley (52) and the third pulley (53) and further to the bottom bar (4) of the screening arrangement (100). 20
14. A screening arrangement according to any one of the preceding claims, wherein said the spring device comprises forming at least one traction cord with at least one elastic portion. 25
15. A screening arrangement according to any one of the preceding claims, wherein the extensible screen (6) defines a screening plane in the deployed position and the screening arrangement (100) further comprises a positioning element, preferably comprising a guide roller (7), having a positioning surface arranged to position the extensible screen (6) in the predefined screening plane. 30
16. A screening arrangement according to any one of the preceding claims, wherein the variable permeability of the screen (6) is achieved by apertures (8) in the material such that when traction is applied to the material in the first direction, the apertures (8) increase in size, at least in said first direction. 35

17. A screening arrangement according to claim 16, wherein the material is one of the following: a textile made with at least one of elastic, lamellae, knits, pleat, non-woven or the like. 40
18. A screening arrangement according to any one of claims 16 and 17, wherein means are provided to keep the extensible screen (6) substantially inextensible in a direction substantially perpendicular to said first direction, such that when traction is exerted on the screen in the first direction, the dimension (B) in the second direction is substantially unchanged. 45
19. A screening arrangement according to any of the preceding claims, wherein means are provided that limit the extension of the extensible screen in said first direction. 50
20. A screening arrangement according to any one of the preceding claims, wherein the drive means comprises a tubular motor incorporated in the roller shaft (1), the tubular motor being preferably connected to a control system including calibration means such as a revolution counter and/or one or more sensors, preferably said control system is configured to detect an increase in the power consumption of the tubular motor. 55
21. A method for providing variable screening of a window, the method comprising the steps of:

providing a screening arrangement (100) comprising an extensible screen (6) having a predefined length between a first end portion (61) and a second end portion (62),
providing a roller shaft (1) and connecting the first end portion (61) of the extensible screen (6) to the roller shaft (1),
winding at least a portion of the extensible screen (6) onto the roller shaft (1) to provide a non-screening position,
providing traction means comprising a cord system including at least one traction cord (3) having a first end (3a) and a second end (3b), and a spring device (5; 50),
connecting the first end (3a) of the traction cord (3) to the roller shaft (1) and the second end (3b) to the second end portion (62) of the extensible screen (6),
associating the at least one traction cord (3) to the spring device (5; 50) to provide pre-tensioning of the at least one traction cord (3),
unwinding the screen (6) by rotating the roller shaft (1) in a first rotational direction to a first screening position, in which the extensible screen (6) is in a first stretched state,
winding the at least one traction cord (3) onto the roller shaft (1) during the unwinding of the

screen (6), and
continuing the rotation of the roller shaft (1) in
the first rotational direction to a second screen-
ing position in which the extensible screen (6)
is in a second stretched state, the permeability 5
of the extensible screen (6) being decreased in
said second stretched state relative to said first
stretched state.

22. The method according to claim 21, wherein the pre- 10
tensioning of the cord system is interrelated to the
rotation of the roller shaft (1) during the movement
from the non-screening position via the first screen-
ing position to the second screening position, such
that: 15

- a. the tension in the extensible screen (6) ex-
ceeds the tension of the cord system during the
movement from the non-screening position to
the first screening position; and 20
b. the tension in the extensible screen (6) is low-
er than the tension in the cord system in the sec-
ond screening position.

23. The method according to claim 21 or 22, wherein the 25
pre-tensioning of the cord system provides for a cord
reserve to accommodate a surplus length of the at
least one traction cord (3) when the extensible
screen (6) is brought from the first stretched state to
the second stretched state. 30

35

40

45

50

55

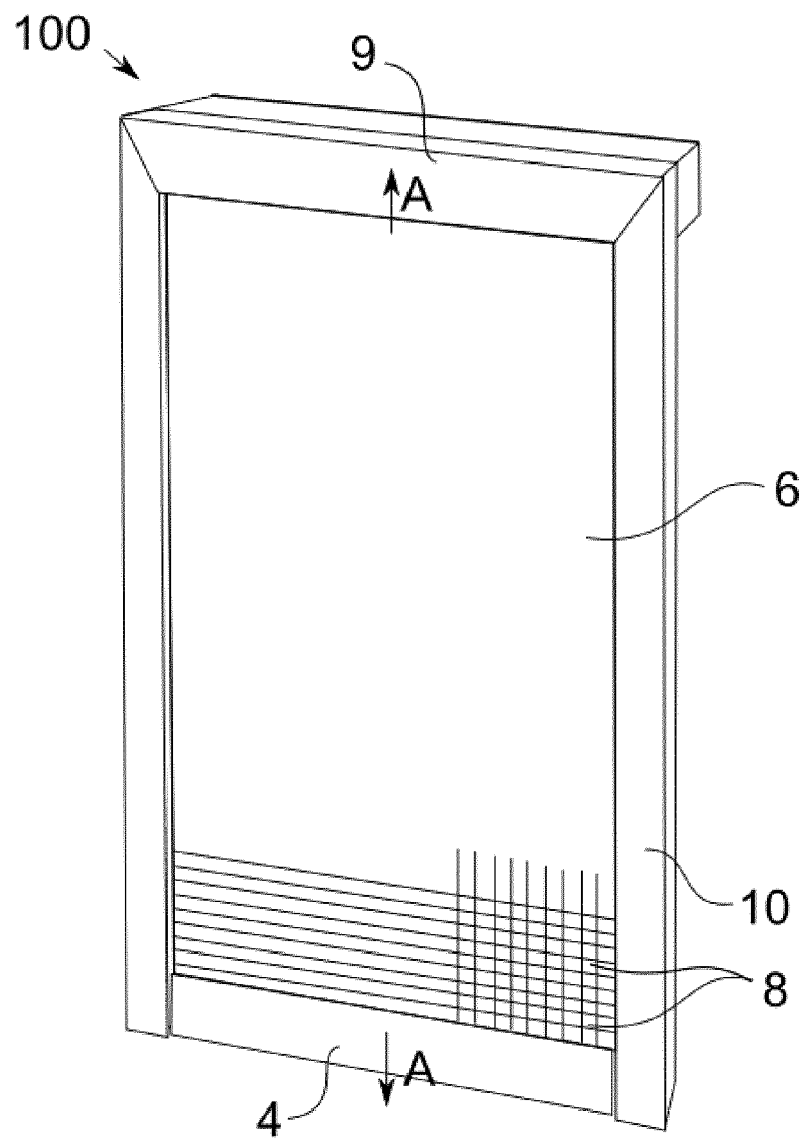


Fig. 1

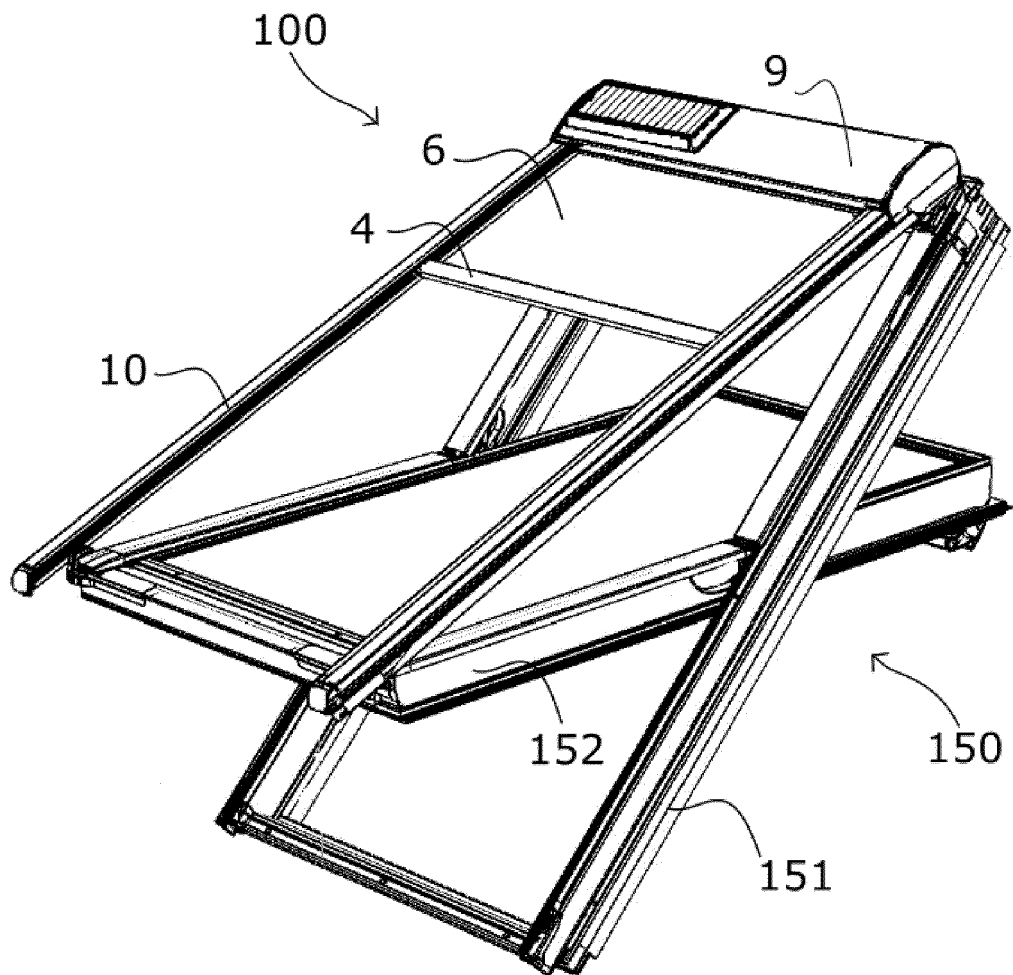


Fig. 1a

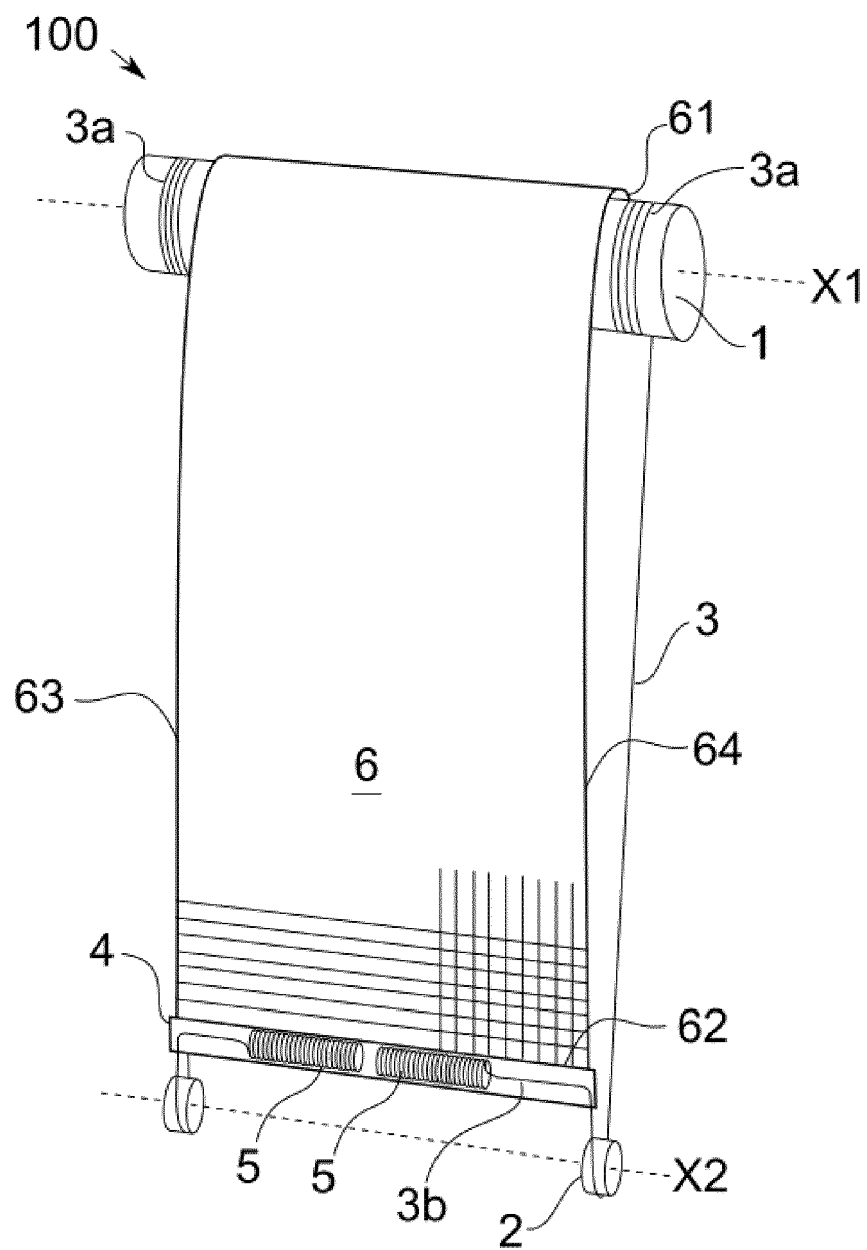


Fig. 2

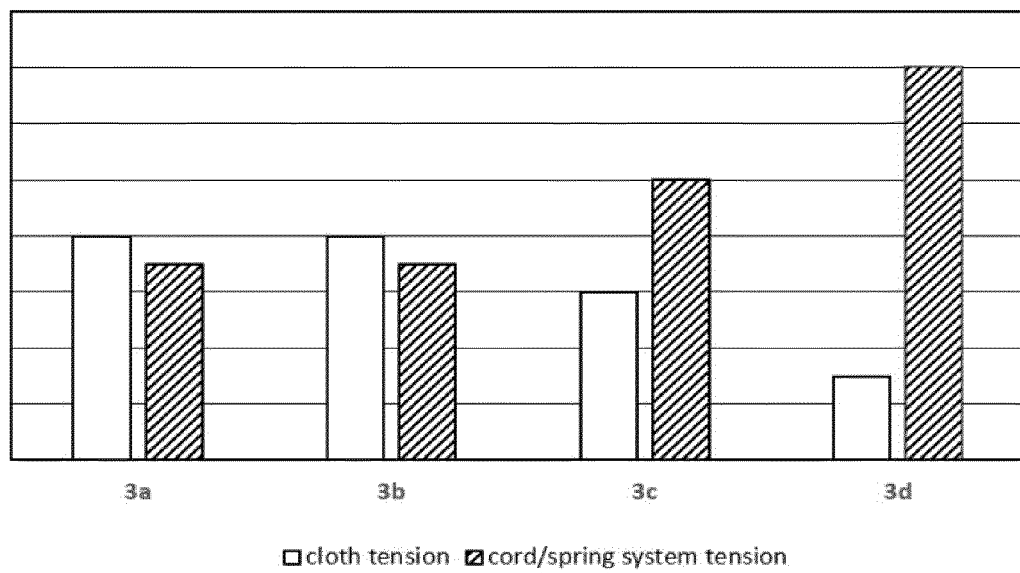
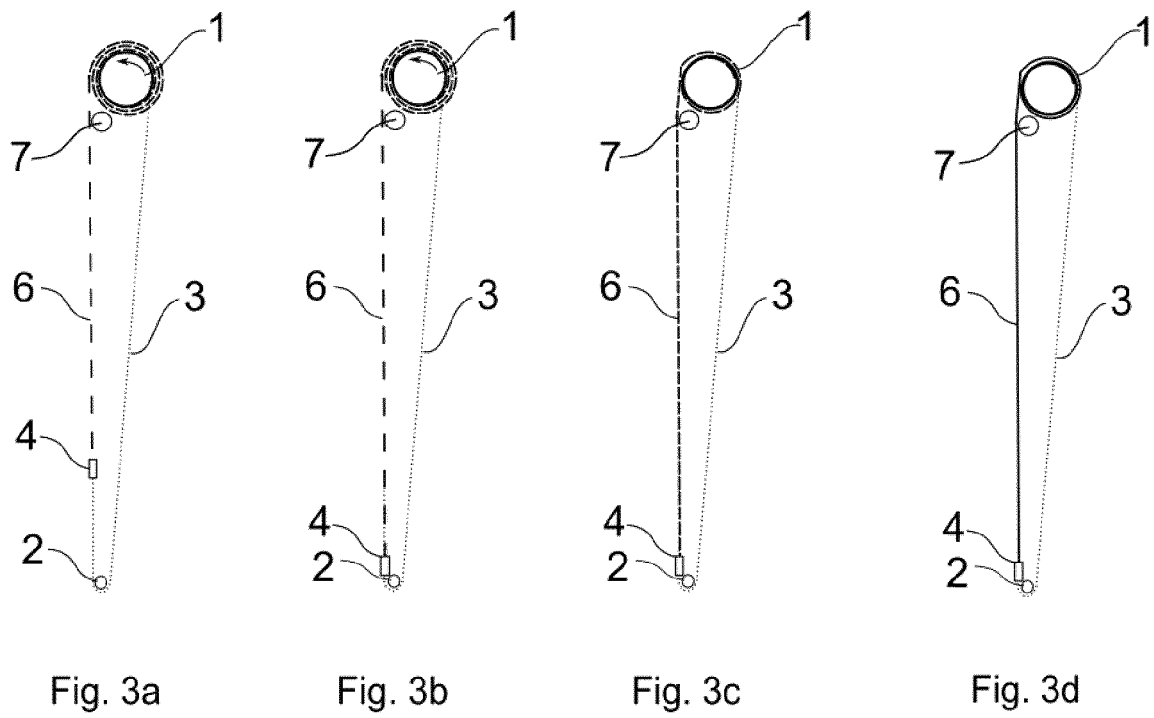


Fig. 4

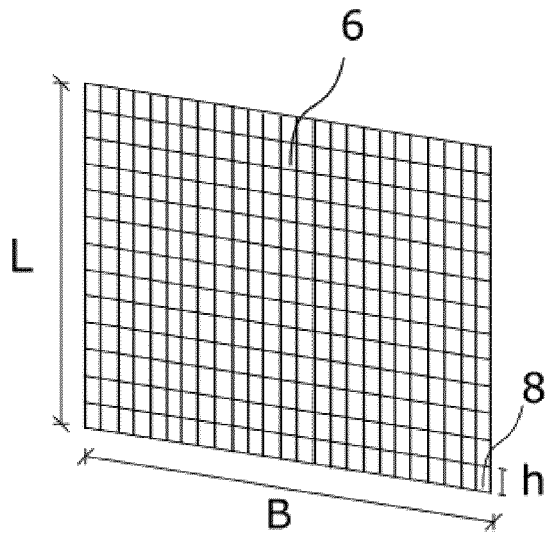


Fig. 5a

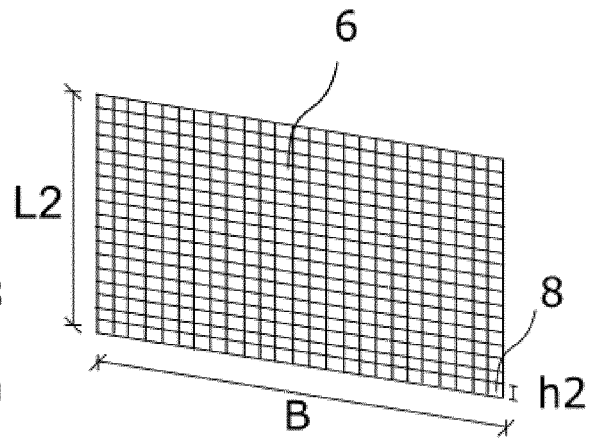


Fig. 5b

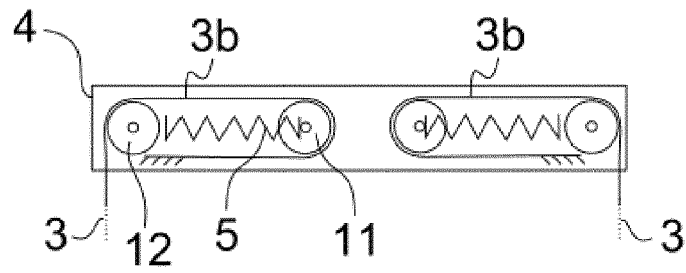


Fig. 6

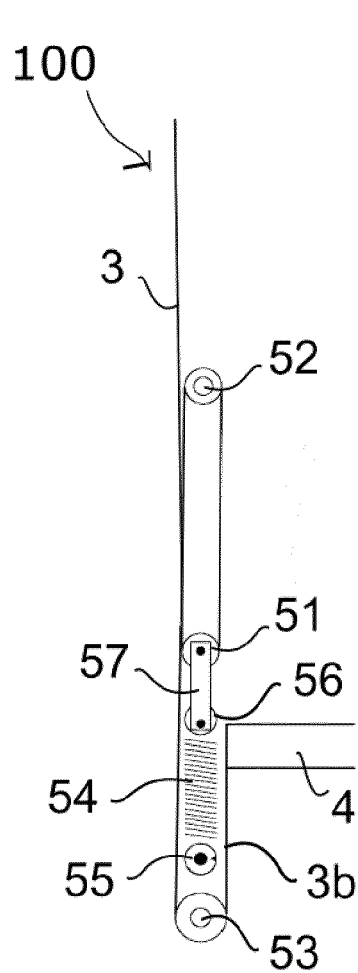


Fig. 7b

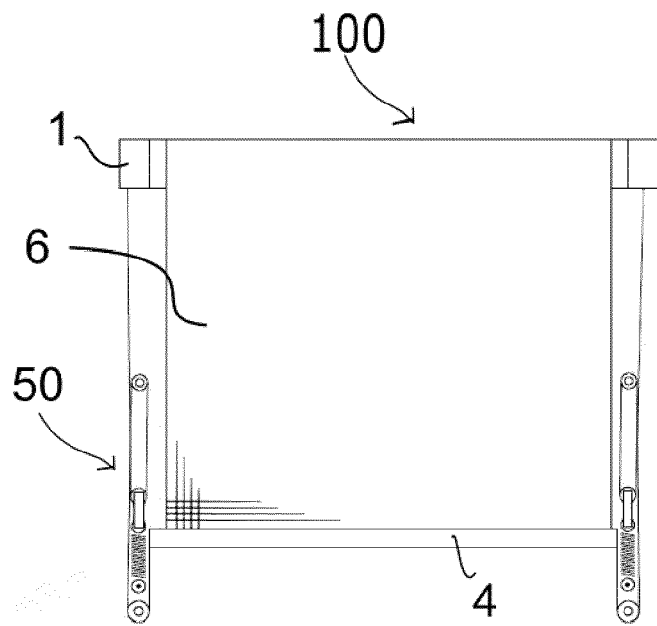


Fig. 7a



EUROPEAN SEARCH REPORT

Application Number
EP 18 16 6098

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	US 2015/191971 A1 (CAVAREC PIERRE-EMMANUEL [FR] ET AL) 9 July 2015 (2015-07-09) * abstract; figures 2a-2e *	1-23	INV. E06B9/42 D03D15/08
A	US 2015/247267 A1 (COREY JOHN A [US]) 3 September 2015 (2015-09-03) * abstract; figures 1,2 *	1-23	
A,D	WO 2011/150902 A1 (PENN TEXTILE SOLUTIONS GMBH [DE]; REGENSTEIN KLAUS-JOACHIM [DE]) 8 December 2011 (2011-12-08) * abstract; figure 4 *	1-23	
A	EP 0 333 677 A2 (SILVESTRI NICOLA) 20 September 1989 (1989-09-20) * column 1, line 35 - column 2, line 19; figures 1-2 *	1-23	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			E06B D03D
Place of search		Date of completion of the search	Examiner
Munich		27 July 2018	Kofoed, Peter
CATEGORY OF CITED DOCUMENTS		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	
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			

 1
EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 16 6098

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-07-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015191971 A1	09-07-2015	EP 2847411 A1	18-03-2015
		FR 2992675 A1	03-01-2014
		US 2015191971 A1	09-07-2015
		WO 2014005971 A1	09-01-2014

US 2015247267 A1	03-09-2015	NONE	

WO 2011150902 A1	08-12-2011	CN 103025939 A	03-04-2013
		DE 102010022059 A1	01-12-2011
		DK 2576879 T3	16-10-2017
		EP 2576879 A1	10-04-2013
		ES 2644374 T3	28-11-2017
		WO 2011150902 A1	08-12-2011

EP 0333677 A2	20-09-1989	EP 0333677 A2	20-09-1989
		IT 1219507 B	18-05-1990

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 20150191971 A1 [0003]
- WO 2011150902 A1 [0023]