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(54) **A SHADING SYSTEM WITH ACTUATOR OVERLOAD PROTECTION**

(57) A shading system (1) for covering an underlying space (2), comprising:
- a housing (11);
- a plurality of shading blades (12);
- a coupling system arranged between the housing (11) and the plurality of shading blades (12), comprising:
◦ a first rail (131) and a second rail (132); wherein each of the shading blades (12) is rotatably coupled to the first rail (131) and to the second rail (132);
◦ a support assembly (134) comprising:
▪ a casing (41) comprising a resilient member (410) at each of its opposite ends; and
▪ a support element (42) fixedly coupled to the first rail (131) and configured to translate between the resilient members (410) from the casing (41);

- an actuator (14) translating the first rail (131) and triggering a translation of the support elements (42) and a rotation of the shading blades (12).

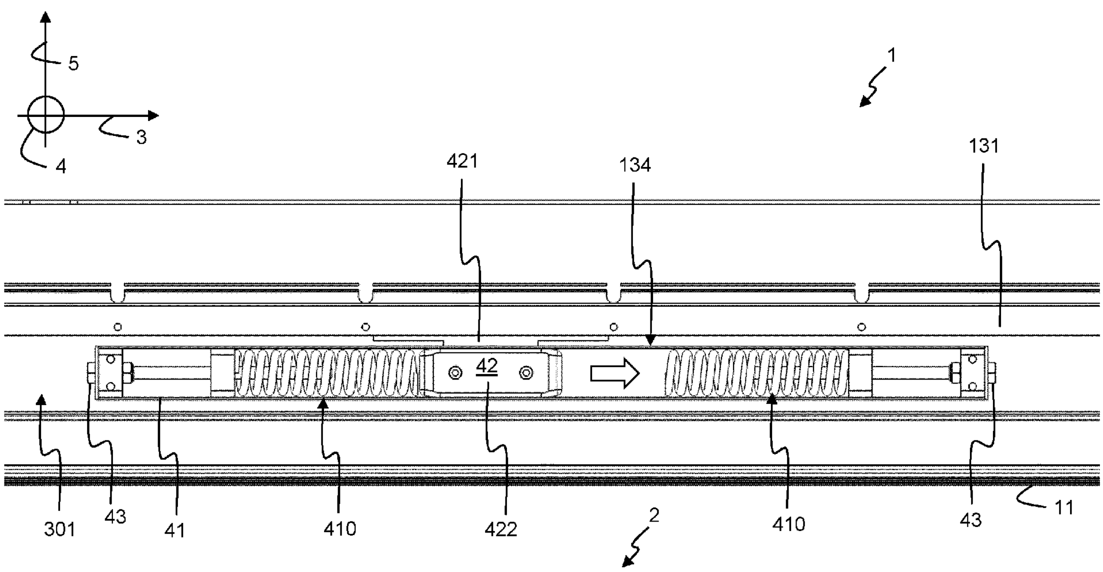

Fig. 3

Description

Field of the Disclosure

[0001] The present disclosure generally relates to a shading system for covering an underlying space. More particularly, the present disclosure generally relates to a shading system for protecting an underlying space from weathering agents and in particular from sun and rain.

Background of the Disclosure

[0002] Several solutions for shading devices for outdoor areas are known, which comprise a support structure, such as for example a canopy, fixed to the ground and provided with a longitudinal frame which supports a plurality of shading blades. The shading blades are mounted on the frame such that the shading blades can rotate with respect to the frame between an open position and a closed position in which the shading blades protect an underlying space.

[0003] An example of such a covering apparatus is described in EP3591136A1. The shading system of EP3015618A1 is used in pergolas, awnings, blinds, louver drive systems, verandas, structures with rotatable lamellae or roofs for covering outdoor settings, such as for example gardens of private homes or open spaces of public spaces, etc. The shading system of EP3015618A1 comprises a housing, a plurality of shading blades and a coupling system arranged between the housing and the plurality of shading blades. The coupling system comprises a coupling element, a first rail and a second rail, and each of the shading blades is rotatably coupled to the first rail and to the second rail. An actuator, such as for example a motor, is used to actuate the coupling system of the shading system, by translating the first rail along the housing while a translation of the second rail along the housing is limited by the coupling element. The actuator thereby rotates the shading blades between a closed position covering an underlying space and at least one open position.

[0004] For example, when the actuator of EP3591136A1 translates the first rail towards the left of the housing, the shading blades are closing. A weight of the shading blades is then transposed towards the second rail, which is translated towards the left of the housing by a large mechanical force. To compensate for this large mechanical force, the actuator of the shading system of EP3591136A1 acts more as a break for the rotation of the shading blades under the weight of the shading blades than as a motor. On the contrary, in the same example, to open the shading blades, a large mechanical force must be applied by the actuator of the shading system of EP3591136A1 to translate the first rail towards the right of the housing so that the shading blades are rotated until they are in an open position. Depending on the dimensions of the shading system described in EP3591136A1, a mechanical force of 10kN may have to be exerted by the actuator to rotate the shading blades to an open position. The shading system of EP3591136A1 therefore requires a strong actuator, for example a strong motor which can generate large mechanical forces. Such actuators are typically bulky and their integration into a housing of the shading system forms a real challenge in view of their size and weight, thereby limiting the reduction of weight and size of the housing of the shading system.

Summary of the Disclosure

[0005] It is thus an object of embodiments of the present disclosure to propose a shading system for covering an underlying space and a manufacturing method thereof which do not show the inherent shortcomings of the prior art. More specifically, it is an object of embodiments of the present disclosure to propose a shading system and a manufacturing method thereof wherein less mechanical force must be exerted by an actuator of the shading system to rotate the shading blades.

[0006] The scope of protection sought for various embodiments of the disclosure is set out by the independent claims.

[0007] The embodiments and features described in this specification that do not fall within the scope of the independent claims, if any, are to be interpreted as examples useful for understanding various embodiments of the disclosure.

[0008] There is a need for a shading system in which lower mechanical forces must be generated to rotate the shading blades, thereby increasing a lifetime of an actuator of the shading system and allowing the shading system to rely on a more compact actuator. Additionally, there is a need for a method of manufacturing such shading system, i.e., a method for covering an underlying space with such a shading system.

[0009] This object is achieved, according to a first example aspect of the present disclosure, by a shading system for covering an underlying space, the shading system comprising:

- a housing extending along a longitudinal housing direction;
- a plurality of shading blades being movable between a closed position thereby covering the underlying space, and at least one open position;
- a coupling system arranged between the housing and the plurality of shading blades, wherein the coupling system comprises:
    - ◦ a first rail and a second rail, both configured to translate along the longitudinal housing direction; wherein each of the shading blades is rotatably coupled to the first rail and rotatably coupled to the second rail;
    - ◦ at least one support assembly, wherein each support assembly comprises:

- a casing extending along the longitudinal housing direction and comprising at least one resilient member at each of the opposite ends of the casing; and
- a support element fixedly coupled to the first rail and configured to translate along the longitudinal housing direction and between resilient members from opposite ends of the casing;

- an actuator configured to translate the first rail along the longitudinal housing direction, thereby triggering a translation of the support elements along the longitudinal housing direction and further triggering a rotation of the shading blades between the closed position and the at least one open position.

[0010] This way, the actuator of the shading system according to the present disclosure is not required to exert or generate large mechanical forces to rotate the shading blades between the closed position and at least one open position. The support assembly according to the present disclosure assists the actuator when translating the first rail along the longitudinal housing direction. Indeed, the support assembly according to the present disclosure comprises a support element which is fixedly coupled to the first rail. The support assembly further comprises a casing extending along the longitudinal housing direction and comprising at least one resilient member at each end of the casing along the longitudinal housing direction. A position of a casing is fixed with respect to the housing along the longitudinal housing direction. In other words, the casing does not translate along the longitudinal housing direction. The casing hosts the support element so that the support element is positioned in the casing between two resilient members of the casing while being fixedly coupled to the first rail. This way, along with the first rail, the support element according to the present disclosure can translate in the casing along the longitudinal housing direction between two resilient members positioned at each opposite ends of the casing. Each resilient member is configured to absorb at least partially the mechanical force generated by the plurality of shading blades.

[0011] For example, when the actuator of the shading system according to the present disclosure translates the first rail towards the left of the housing along the longitudinal housing direction, the shading blades of the shading system according to the present disclosure are closing. As the support element is fixedly coupled to the first rail, the actuator simultaneously triggers the translation of the support element of the support assembly in the casing and along the longitudinal housing direction. A weight of the shading blades is transposed towards the second rail, which is translated towards for example the left of the housing by a large mechanical force. The support element translates in the casing until the support element comes in contact with at least one resilient member in the casing. When the support element is abutted in its translation in the casing by a resilient member, the resilient member absorbs at least partially the mechanical force exerted by the plurality of shading blades on the coupling system when the shading blades are closing. In other words, the resilient members according to the present disclosure counterbalance at least partially the mechanical force exerted by the plurality of shading blades, thereby assisting the actuator in its operation of closing the plurality of shading blades and supporting the weight of the shading blades while doing so. The resilient members according to the present disclosure reduce the power required by the actuator to rotate the shading blades, more particularly to close the plurality of shading blades, thereby preventing the actuator from operating with excessive force when closing the shading blades and protecting the actuator from overload. For example, when the resilient members are springs, the resilient members may compress from their resting positions to a compressed position in response of the translation of the support element in the casing when the support element comes in contact with the resilient members. This way, the actuator is not required anymore to exert large mechanical forces, for example up to 10kN, to rotate the shading blades to a closed position. An actuator able to generate large mechanical forces is therefore not necessary anymore. An actuator smaller in size and in weight actuator may be used in the shading system, thereby allowing a reduction in size and weight of the shading system according to the present disclosure.

[0012] For example, to rotate the shading blades to at least one open position, the actuator of the shading system according to the present disclosure translates the first rail towards the right of the housing so that the shading blades are rotated until they are in an open position. As the support element is fixedly coupled to the first rail, the actuator simultaneously triggers the translation of the support element of the support assembly in the casing and along the longitudinal housing direction. A weight of the shading blades is transposed towards the second rail, which is translated towards for example the right of the housing by a large mechanical force. The support element translates in the casing until the support element is not in contact anymore with the resilient members in the casing with which the support element was in contact when the shading blades were in a closed position. The resilient members thereby provide support for the actuator when rotating the shading blades to an open position. For example, when the resilient members are springs, the resilient members may stretch in response of the translation of the support element in the casing from a compressed position to a resting position, thereby providing mechanical support to the actuator when carrying the weight of the shading blades to rotate the shading blades to an open position. In other words, the resilient members according to the present disclosure counterbalance at least partially the mechanical force exerted by the plurality of shading blades, thereby assisting the actuator in its operation of opening the plurality of shading blades and supporting the weight of the shading blades while doing so. The resilient members according to the present disclosure reduce the power required by the actuator to rotate the shading blades, more particularly to open the plurality of shading blades, thereby preventing the actuator from operating with excessive force when opening the shading blades and protecting the actuator from overload. In other words, with the shading system according to the present disclosure, a lower mechanical force is needed to open the shading blades than with a shading system without the support assembly according to the present disclosure. This way, the actuator is not required anymore to exert large mechanical forces, for example up to 10kN, to rotate the shading blades to an open position. An actuator able to generate large mechanical forces is therefore not necessary anymore. An actuator smaller in size and in weight actuator may be used in the shading system, thereby allowing a reduction in size and weight of the shading system according to the present disclosure. The actuator will rotate the shading blades and will trigger the translation of the support element in the casing until the support element comes in contact with at least one resilient member in the casing. The resilient members which limit the translation of the support element in the casing when the shading blades are opening is positioned at an end of the casing opposite to the end wherein one or more resilient members are positioned to limit the translation of the support element in the casing when the shading blades are closing. When the support element is abutted in its translation in the casing by a resilient member when the shading blades are rotating to an open position, the resilient member absorbs at least partially the mechanical force exerted by the plurality of shading blades on the coupling system, thereby slowing down the rotation of the shading blades and preventing the shading blades from rotating past a predetermined angle with respect to the closed position. For example, when the resilient members are springs, the resilient members may compress from their resting positions to a compressed position in response of the translation of the support element in the casing when the support element comes in contact with the resilient members.

[0013] Alternatively, the shading system according to the present disclosure comprises more than one actuator configured to translate the first rail along the longitudinal housing direction, for example two, three, four, five, etc. actuators. Alternatively, the shading system according to the present disclosure comprises more than one coupling element to limit the translation of the second rail along the longitudinal housing direction when the actuator translates the first rail along the longitudinal housing direction, for example two, three, four, five, etc. coupling elements. Alternatively, the first rail of the shading system according to the present disclosure comprises more than one rail and/or the second rail of the shading system according to the present disclosure comprises more than one rail. For example, the first rail comprises two, three, four, five, etc.. rails arranged one after the other along the longitudinal housing direction and which extend along the longitudinal housing direction and which can translate along the longitudinal housing direction. For example, the second rail comprises two, three, four, five, etc.. rails arranged one after the other along the longitudinal housing direction and which extend along the longitudinal housing direction and which can translate along the longitudinal housing direction. The shading blades are movable between a closed position thereby covering the underlying space, and at least one open position. The shading blades are also movable between at least one open position and a closed position in which they cover the underlying space. Alternatively, the shading blades are movable between at least two open positions. The shading blades for example rotate between at least two open positions. The movement of the shading blades between the closed position and at least one open position or between at least two open positions can happen abruptly at once. Alternatively, the movement of the shading blades between the closed position and at least one open position or between at least two open positions can happen gradually during which an opening between two consecutive shading blades gradually increases when the plurality of shading blades moves between a closed position and at least one open position or when the plurality of shading blades moves between at least one open position and a further open position more open than the first one, or during which an opening between two consecutive shading blades gradually decreases when the plurality of shading blades moves between at least one open position and a closed position or when the plurality of shading blades moves between at least one open position and a further open position less open than the first one.

[0014] The casing according to the present disclosure may have any shape, such as for example cubic, parallelepipedal, cylindrical, etc. The upper portion of the support element according to the present disclosure may have any shape, such as for example cubic, parallelepipedal, cylindrical, etc. The lower portion of the support element according to the present disclosure may have any shape, such as for example cubic, parallelepipedal, cylindrical, etc. as long as the lower portion can translate in the casing between resilient members. The shading system according to the present disclosure comprises for example a plurality of support assemblies spread along the longitudinal housing direction. For example, the shading system according to the present disclosure comprises two, three, four, five, etc. support assemblies.

[0015] The shading system according to the present disclosure relates to the field of example pergolas. A pergola is for example a garden feature forming a shaded walkway, passageway, or sitting area of vertical posts or pillars that usually support the housing and the plurality of shading blades. Alternatively, the shading system according to the present disclosure relates to the field of awnings or blinds comprising rotatable lamellae or roofs of verandas. Alternatively, the shading system according to the present disclosure relates to the field of louver drive systems.

[0016] The first rail according to the present disclosure comprises a first longitudinal axis along the longitudinal housing direction. In other words, the first rail according to the present disclosure extends along the longitudinal housing direction. The second rail according to the present disclosure comprises a second longitudinal axis along the longitudinal housing direction. In other words, the second rail according to the present disclosure extends along the longitudinal housing direction. The expression "extending along a direction" is understood in the context of the present disclosure as "comprising a respective axis along the direction". In other words, the expression "extending along a direction" is understood as "being arranged and being parallel to the direction".

[0017] According to example embodiments, the first rail comprises at least one slot extending along the longitudinal housing direction; and the support elements each comprise:

- an upper portion fitting in one of the slots and fixedly coupled to the first rail; and
- a lower portion fixedly coupled to the upper portion and fitting between two resilient members from opposite ends of the casing.

[0018] This way, the upper portion of the support element ensures the support element is fixedly coupled to the first rail and that the support element translated with the first rail along the longitudinal housing direction. The upper portion and the lower portion are fixedly coupled together so that the upper portion triggers the translation of the lower portion in the casing between the resilient members when the upper portion translates with the first rail along the longitudinal housing direction. The first rail comprises at least one slot extending along the longitudinal housing direction. The first rail for example a plurality of slots extending along the longitudinal housing direction, such as for example two, three, four, five, etc. slots. Each slot is configured to host a support element such that the upper portion of the support element fits in the slot.

[0019] According to example embodiments, the upper portions are configured to translate in the slots along the longitudinal housing direction.

[0020] This way, a translation movement of the first rail and a translation movement of the upper portions of the support elements are parallel to each other in the shading system. This ensures a direct transmission of the translation of the first rail to the upper portions of the support elements. Positions of the casings of the support assemblies remain fixed with respect to the first rail along the longitudinal housing direction, while the upper portions of the support elements may translate in the slots along the longitudinal housing direction.

[0021] According to example embodiments, the resilient members extend in the casing along the longitudinal housing direction.

[0022] This maximizes the technical effect of the resilient members: the absorption of the mechanical force generated by the plurality of shading blades is maximized when the resilient members extend in the casing along the longitudinal housing direction.

[0023] According to example embodiments, the resilient members are springs.

[0024] A resilient member according to the present disclosure is for example a spring. Alternatively, a resilient member according to the present disclosure is for example a piston. Alternatively, the casing comprises a combination of resilient members different natures, for example one or more springs and one or more pistons. Alternatively, a resilient member is any suitable type of system which can provide mechanical support to the actuator in opening and closing the shading blades.

[0025] According to example embodiments, the resilient members are configured to be compressed in the casing by the lower portions when the support elements translate along the longitudinal housing direction until they come in contact with the resilient members; and the resilient members are configured to be expand in the casing when the lower portions are not in contact with the resilient members.

[0026] As described above, the resilient members are compressed in the casing by the lower portions when the support elements translate along the longitudinal housing direction until they come in contact with the resilient members and when the first rail is further translated along the longitudinal housing direction. The resilient members also stretch back to a resting position in the casing when the lower portions are not in contact with the resilient members anymore.

[0027] According to example embodiments, the casing further comprises an adjusting system at each of the opposite ends of the casing, wherein an adjusting system is configured to adjust a length of the resilient members along the longitudinal housing direction.

[0028] For example, a length of the resilient members along the longitudinal housing direction may be adjusted, for example made shorter or longer. This way, it becomes possible to adjust a distance along the longitudinal housing direction between an edge of a resilient member and an edge of the lower portion of a support element facing the edge of the resilient member along the longitudinal housing direction. This way, a distance available for translation of the lower portion of a support element along the longitudinal housing direction is either made shorter - when a length of the resilient members along the longitudinal housing direction is made longer - or longer - when a length of the resilient members along the longitudinal housing direction is made shorter. When the distance available for translation of the lower portion of a support element along the longitudinal housing direction is made shorter, the lower portion comes faster in contact with the resilient members and the action of the support assembly takes place early in the rotation of the shading blades. This provides faster and stronger support to the actuator in the process of rotating the shading blades. When the distance available for translation of the lower portion of a support element along the longitudinal housing direction is made longer, the lower portion comes less fast in contact with the resilient members and the action of the support assembly takes place later in the rotation of the shading blades. This provides later and softer support to the actuator in the process of rotating the shading blades.

[0029] According to example embodiments:

- the shading blades are arranged one after the other along the longitudinal housing direction, each of the shading blades extending along a longitudinal blade direction traverse to the longitudinal housing direction;
- each of the shading blades is rotatably coupled to the first rail at a first coupling point and rotatably coupled to the second rail at a second coupling point; and
- the slots are under the first coupling points along a direction traverse to the longitudinal housing direction and to the longitudinal blade direction.

[0030] All the shading blades of the shading system according to the present disclosure simultaneously rotate between a closed position and at least one open position or between at least one open position and a closed position. Indeed, all the shading blades are rotatably coupled to the same first rail and are also all rotatably coupled to the same second rail such that the rotation of all the shading blades is coordinated and simultaneous. In other words, there is no need with the shading system according to the present disclosure to foresee the manufacturing and/or the mounting of individual coupling elements between each of the shading blades and the housing of the shading system. The design of the shading system according to the present disclosure is therefore simple. Additionally, the design of the shading system according to the present disclosure is compact. Indeed, each shading blade comprises two coupling points on each end of the shading blade along a direction traverse to the longitudinal blade direction: a first coupling point to the first rail and a second coupling point to the second rail. Both coupling points of each shading blade form a rotation point for the corresponding shading blade. In other words, with the shading system according to the present disclosure, there is no need to foresee orientation guides in the housing of the shading system to ensure a complete rotation of the shading blades. Indeed, when the actuator translates the first rail along the longitudinal housing direction, the simultaneous rotation of all the shading blades is achieved when the coupling element of the shading system holds a translation of the second rail along the longitudinal direction back, in other words limits a translation of the second rail along the longitudinal housing direction. The second rail does not rotate with respect to the first rail. In other words, the first rail and the second rail remain parallel to each other even when the shading blades rotate with respect to the longitudinal housing direction. When limiting the translation of the second rail along the longitudinal housing direction, the coupling element rotates with respect to the longitudinal housing direction.

[0031] According to example embodiments, the coupling system further comprises a coupling element rotatably coupled to the housing and rotatably coupled to the second rail; wherein the coupling element limits a translation of the second rail along the longitudinal housing direction, thereby rotating the shading blades between the closed position and the at least one open position when the actuator translates the first rail along the longitudinal housing direction.

[0032] This way, when the coupling element limits the translation of the second rail along the longitudinal housing direction, the second rail moves along a traverse direction traverse to the longitudinal housing direction and to the longitudinal blade direction. The shading blades rotate between the closed position and the open position at the first coupling point around a first rotation axis extending along the longitudinal blade direction.

[0033] According to example embodiments, the coupling element is a rod.

[0034] This way, the design and the mounting of the shading system is made robust, simple and the costs associated are minimized.

[0035] According to example embodiments, the shading system further comprises a rain gutter extending along the longitudinal housing direction and arranged below the plurality of shading blades.

[0036] This way, the risk that rainwater re-ascends from the gutter to the shading blades is minimized in a simple manner, thereby ensuring the space underlying the shading device stays dry. Indeed, as the coupling element limits a translation of the second rail along the longitudinal housing direction when the actuator translates the first rail along the longitudinal housing direction, the space required by the shading blades to carry out a complete rotation between a closed position and at least one open position is minimized. This way, a distance between the shading blades and the rain gutter is minimized and droplets and/or splashes of rainwater are prevented from splashing from the gutter and from falling outside the gutter on the underlying space.

[0037] According to example embodiments, the rain gutter comprises a rain gutter coupling element adapted to couple the rain gutter to the housing and a protecting element extending along the longitudinal housing direction; the protecting element is arranged traverse to the longitudinal blade direction such that shading blades partially overlap the rain gutter along the longitudinal blade direction.

[0038] This way, the protecting element prevents rainwater from re-ascending from the gutter to the shading blades, thereby ensuring the space underlying the shading device stays dry. Additionally, the protecting element extends along the longitudinal housing direction, and preferably along the entire length of the shading system along the longitudinal housing direction. The protecting element thereby protects the underlying space in a simple manner and for all the shading blades of the shading system according to the present invention. An individual drip catcher tab need not be mounted on each of the shading blades. Additionally, the protecting element thereby protects the mechanism of the shading system by ensuring that no dirt enters the housing of the shading system and jeopardizes its functioning. This increases the lifetime of the shading system and minimizes the need for maintenance.

[0039] According to example embodiments, each of the shading blades comprises:

- a strip extending along the longitudinal blade direction, wherein the strip comprises the second coupling point; and
- a blade holder comprising:
    - ◦ a blade holder body configured to support the strip along the longitudinal blade direction;
    - ◦ a first blade holder tip comprising the first coupling point; and
    - ◦ a second blade holder tip opposite the first blade holder tip.

[0040] A plurality of shading blades are arranged one after the other along the longitudinal housing direction, each of the shading blades extending along a longitudinal blade direction traverse to said longitudinal housing direction and the shading blades being movable between a closed position in which the shading blades are arranged partially superimposed, each over the next, thereby covering the underlying space, and at least one open position in which the shading blades are arranged each spaced from the next by an opening. This way, the shading system is made watertight and the space underlying the shading blades stays dry when the shading blades are in a closed position.

[0041] Each shading blade is coupled along a direction traverse to the longitudinal blade direction on one end to the first rail and on another end to the second rail.

[0042] According to example embodiments, when the shading blades are in the closed position, the shading blades are arranged partially superimposed, each over the next, with the second blade holder tip of a shading blade partially superimposing the first blade holder tip of the next shading blade along the longitudinal housing direction; and wherein when the shading blades are in the open position, the shading blades are arranged each spaced from the next by an opening formed between the second blade holder tip of a shading blade and the first blade holder tip of the next shading blade along the longitudinal housing direction.

[0043] This way, the shading system is made watertight and the space underlying the shading blades stays dry when the shading blades are in a closed position. This way, the shading system allows light and other weathering agents to reach the underlying space under the shading blades of the shading system when the shading blades are arranged spaced from the next by an opening.

[0044] According to example embodiments, the protecting element of the rain gutter comprises a brush extending along the longitudinal housing direction; the brush is arranged such that each of the blade holders lies onto the brush in the closed position.

[0045] This way, the shading blades are brushed when moved between a closed position and at least one open position or between at least one open position and a closed position, thereby ensuring the shading blades stay clean and no dirt falls from the shading blades inside the mechanism of the shading system which could jeopardize its functioning. Additionally, the brush is adapted to retain and collect droplets of water which may fall from the shading blades in the underlying space, thereby preventing the droplets of water from falling in the underlying space and keeping the underlying space dry.

[0046] According to a second example aspect of the present disclosure, there is provided a method for covering an underlying space, the method comprising the steps of:

- providing a housing extending along a longitudinal housing direction;
- providing a plurality of shading blades;
- arranging the shading blades such that the shading blades are movable between a closed position thereby covering the underlying space, and at least one open position;
- providing a coupling system arranged between the housing and the plurality of shading blades, wherein the providing a coupling system comprises:
    - ◦ providing a first rail and a second rail, both configured to translate along the longitudinal housing direction; wherein each of the shading blades is rotatably coupled to the first rail and rotatably coupled to the second rail;
    - ◦ providing at least one support assembly, wherein each support assembly comprises:
        - ▪ a casing extending along the longitudinal housing direction and comprising at least one resilient member at each of the opposite ends of the casing; and
        - ▪ a support element fixedly coupled to the first rail and configured to translate along the longitudinal housing direction and between resilient members from opposite ends of the casing;
- translating the first rail along the longitudinal housing

direction; thereby triggering a translation of the support elements along the longitudinal housing direction and further triggering a rotation of the shading blades between the closed position and the at least one open position.

[0047] With the method according to the present disclosure, it is not required to exert or generate large mechanical forces to rotate the shading blades between the closed position and at least one open position. The translation of the first rail along the longitudinal housing direction is assisted. Indeed, the support assembly according to the present disclosure comprises a support element which is fixedly coupled to the first rail. The support assembly further comprises a casing extending along the longitudinal housing direction and comprising at least one resilient member at each end of the casing along the longitudinal housing direction. The casing hosts the support element so that the support element is positioned in the casing between two resilient members of the casing while being fixedly coupled to the first rail. This way, along with the first rail, the support element according to the present disclosure can translate in the casing along the longitudinal housing direction between two resilient members positioned at each opposite ends of the casing. Each resilient member is configured to absorb at least partially the mechanical force generated by the plurality of shading blades.

[0048] For example, when the first rail is translated towards the left of the housing along the longitudinal housing direction, the shading blades of the shading system according to the present disclosure are closing. As the support element is fixedly coupled to the first rail, the translation of the first rail triggers the translation of the support element of the support assembly in the casing and along the longitudinal housing direction. A weight of the shading blades is transposed towards the second rail, which is translated towards for example the left of the housing by a large mechanical force. The support element translates in the casing until the support element comes in contact with at least one resilient member in the casing. When the support element is abutted in its translation in the casing by a resilient member, the resilient member absorbs at least partially the mechanical force exerted by the plurality of shading blades on the coupling system when the shading blades are closing. In other words, the resilient members according to the present disclosure counterbalance at least partially the mechanical force exerted by the plurality of shading blades, thereby assisting the closing of the plurality of shading blades and supporting the weight of the shading blades while doing so. The resilient members according to the present disclosure reduce the power required to rotate the shading blades, more particularly to close the plurality of shading blades, thereby preventing the use of excessive force when closing the shading blades. For example, when the resilient members are springs, the resilient members may compress from their resting positions to a compressed position in response of the translation of the support element in the casing when the support element comes in contact with the resilient members. This way, it is not required anymore to exert large mechanical forces, for example up to 10kN, to rotate the shading blades to a closed position.

[0049] For example, to rotate the shading blades to at least one open position, the first rail is translated towards the right of the housing so that the shading blades are rotated until they are in an open position. As the support element is fixedly coupled to the first rail, the translation of the first rail simultaneously triggers the translation of the support element of the support assembly in the casing and along the longitudinal housing direction. A weight of the shading blades is transposed towards the second rail, which is translated towards for example the right of the housing by a large mechanical force. The support element translates in the casing until the support element is not in contact anymore with the resilient members in the casing with which the support element was in contact when the shading blades were in a closed position. The resilient members thereby provide support when rotating the shading blades to an open position. For example, when the resilient members are springs, the resilient members may stretch in response of the translation of the support element in the casing from a compressed position to a resting position, thereby providing mechanical support when carrying the weight of the shading blades to rotate the shading blades to an open position. In other words, the resilient members according to the present disclosure counterbalance at least partially the mechanical force exerted by the plurality of shading blades, thereby assisting the operation of opening the plurality of shading blades and supporting the weight of the shading blades while doing so. The resilient members according to the present disclosure reduce the power required to rotate the shading blades, more particularly to open the plurality of shading blades, thereby preventing the use of excessive force when opening the shading blades. In other words, with the method according to the present disclosure, a lower mechanical force is needed to open the shading blades than with a method without the support assembly according to the present disclosure. This way, large mechanical forces, for example up to 10kN, need not be exerted to rotate the shading blades to an open position. The shading blades will rotate and will trigger the translation of the support element in the casing until the support element comes in contact with at least one resilient member in the casing. The resilient members which limit the translation of the support element in the casing when the shading blades are opening is positioned at an end of the casing opposite to the end wherein one or more resilient members are positioned to limit the translation of the support element in the casing when the shading blades are closing. When the support element is abutted in its translation in the casing by a resilient member when the shading blades are rotating to an open position, the resilient member absorbs at least partially the mechanical force exerted by the plurality of shading blades on the coupling system, thereby slowing down the rotation of the shading blades and preventing the shading blades from rotating past a predetermined angle with respect to the closed position. For example, when the resilient members are springs, the resilient members may compress from their resting positions to a compressed position in response of the translation of the support element in the casing when the support element comes in contact with the resilient members.

[0050] This way, all the shading blades of the shading system according to the present disclosure simultaneously rotate between a closed position and at least one open position or between at least one open position and a closed position. Indeed, all the shading blades are rotatably coupled to the same first rail and are also all rotatably coupled to the same second rail such that the rotation of all the shading blades is coordinated and simultaneous. In other words, there is no need with the shading system according to the present disclosure to foresee the manufacturing and/or the mounting of individual coupling elements between each of the shading blades and the housing of the shading system. The design of the shading system according to the present disclosure is therefore simple. Additionally, the design of the shading system according to the present disclosure is compact. Indeed, each shading blade comprises two coupling points on each end of the shading blade along a direction traverse to the longitudinal blade direction: a first coupling point to the first rail and a second coupling point to the second rail. Both coupling points of each shading blade form a rotation point for the corresponding shading blade. In other words, the translation movement required to rotate each shading blade between the closed position and the open position or vice versa is much shorter than the translation movement required in the covering apparatus of EP3015618A1 to rotate a covering blade using only one fixed rotation point and an orientation guide. With the shading system according to the present disclosure, there is no need to foresee orientation guides in the housing of the shading system to ensure a complete rotation of the shading blades: when the actuator translates the first rail along the longitudinal housing direction, the simultaneous rotation of all the shading blades is achieved when the coupling element of the shading system holds a translation of the second rail along the longitudinal direction back, in other words limits a translation of the second rail along the longitudinal housing direction.

Brief Description of the Drawings

[0051]

Fig. 1A schematically illustrates a cross-section of an embodiment of a shading system according to the prior art wherein the shading blades are being rotated to an open position. Fig. 1B schematically illustrates a cross-section of an embodiment of a shading system according to the prior art wherein the shading blades are being rotated to a closed position.

Fig. 2 schematically illustrates a perspective view of an embodiment of a support assembly according to the present disclosure.

Fig. 3 schematically illustrates a cross-section of an embodiment of a coupling system according to the present disclosure, wherein the coupling system comprises a support assembly according to the present disclosure.

Fig. 4 schematically illustrates a perspective view of an embodiment of a coupling system according to the present disclosure, wherein the coupling system comprises a support assembly according to the present disclosure.

Fig. 5 schematically illustrates a perspective view of an embodiment of a shading system according to the present disclosure, wherein the shading system comprises a support assembly according to the present disclosure.

Fig. 6 schematically illustrates mechanical forces measured when a shading system according to the present disclosure operates.

Fig. 7 schematically illustrates a cross-section of an embodiment of a shading system according to the present invention wherein the shading blades are in a closed position.

Fig. 8A schematically illustrates a side view of a cross-section of an embodiment of a shading system according to the present invention wherein the shading blades are in an open position. Fig. 8B schematically illustrates a side view of a cross-section of an embodiment of a shading system according to the present invention wherein the shading blades are in a closed position.

Detailed Description of Embodiment(s)

[0052] According to a cross-section of an embodiment of a shading system 1 according to the prior art shown in Fig. 1A, the shading system 1 for covering an underlying space 2 comprises a housing 11, a plurality of shading blades 12 and a coupling system arranged between the housing 11 and the plurality of shading blades 12. The shading blades 12 are being rotated to an open position 7. The coupling system comprises a first rail 131 and a second rail 132, both configured to translate along the longitudinal housing direction 3. Each of the shading blades 12 is rotatably coupled to the first rail 131 at a first coupling point 121 and rotatably coupled to the second rail 132 at a second coupling point 122. The shading system 1 further comprises an actuator 14 which translates the first rail 131 along the longitudinal housing direction 3, thereby triggering a rotation of the shading blades 12 to the open position 7. The coupling system further comprises a coupling element 133 rotatably coupled to the housing 11 and rotatably coupled to the second rail 132. The coupling element 133 limits a translation of the second rail 132 along the longitudinal housing direction 3, thereby rotating the shading blades 12 to the open position 7 when the actuator translates the first rail 131 along the longitudinal housing direction 3. Each of the shading blades 12 comprises a strip 221 and a blade holder 222. Each strip 221 extends along the longitudinal blade direction 4, and each strip 221 comprises the second coupling point 122 of the respective shading blade 12. Each blade holder 223 comprises a blade holder body 223, a first blade holder tip 224 and a second blade holder tip 225. Each blade holder body 223 supports the strip 221 along the longitudinal blade direction 4. Each first blade holder tip 224 comprises the first coupling point 121 of the respective shading blade 12. Each second blade holder tip 225 is arranged opposite each respective first blade holder tip 224. To open the shading blades 12, a large mechanical force must be applied by the actuator of the shading system 1 according to the prior art to translate the first rail 131 towards the right of the housing 11 so that the shading blades 12 are rotated until they are in the open position 7. Depending on the dimensions of the shading system 1 according to the prior art, a mechanical force of 10kN may have to be exerted by the actuator 14 to rotate the shading blades 12 to the open position 7. The shading system 1 according to the prior art therefore requires a strong actuator 14, for example a strong motor which can generate large mechanical forces. Such actuators are typically bulky and their integration into a housing of the shading system forms a real challenge in view of their size and weight, thereby limiting the reduction of weight and size of the housing of the shading system.

[0053] According to a cross-section of an embodiment of a shading system 1 according to the prior art shown in Fig. 1B, the shading system 1 for covering an underlying space 2 comprises a housing 11, a plurality of shading blades 12 and a coupling system arranged between the housing 11 and the plurality of shading blades 12. The shading blades 12 are being rotated to a closed position 6. The coupling system comprises a first rail 131 and a second rail 132, both configured to translate along the longitudinal housing direction 3. Each of the shading blades 12 is rotatably coupled to the first rail 131 at a first coupling point 121 and rotatably coupled to the second rail 132 at a second coupling point 122. The shading system 1 further comprises an actuator 14 which translates the first rail 131 along the longitudinal housing direction 3, thereby triggering a rotation of the shading blades 12 to the closed position 6. The coupling system further comprises a coupling element 133 rotatably coupled to the housing 11 and rotatably coupled to the second rail 132. The coupling element 133 limits a translation of the second rail 132 along the longitudinal housing direction 3, thereby rotating the shading blades 12 to the closed position 6 when the actuator translates the first rail 131 along the longitudinal housing direction 3. Each of the shading blades 12 comprises a strip 221 and a blade holder 222. Each strip 221 extends along the longitudinal blade direction 4, and each strip 221 comprises the second coupling point 122 of the respective shading blade 12. Each blade holder 223 comprises a blade holder body 223, a first blade holder tip 224 and a second blade holder tip 225. Each blade holder body 223 supports the strip 221 along the longitudinal blade direction 4. Each first blade holder tip 224 comprises the first coupling point 121 of the respective shading blade 12. Each second blade holder tip 225 is arranged opposite each respective first blade holder tip 224. When the actuator 14 of the shading system 1 according to the prior art translates the first rail 131 towards the left of the housing 11, the shading blades 12 are closing. A weight of the shading blades 12 is then transposed towards the second rail 132, which is translated towards the left of the housing 11 by a large mechanical force. To compensate for this large mechanical force, the actuator 14 of the shading system 1 according to the prior art acts more as a break for the rotation of the shading blades 12 under the weight of the shading blades 12 than as a motor. Depending on the dimensions of the shading system 1 according to the prior art, a mechanical force of 10kN may have to be exerted by the actuator 14 to rotate the shading blades 12 between the closed position 6 and an open position 7. The shading system 1 according to the prior art therefore requires a strong actuator 14, for example a strong motor which can generate large mechanical forces. Such actuators are typically bulky and their integration into a housing of the shading system forms a real challenge in view of their size and weight, thereby limiting the reduction of weight and size of the housing of the shading system.

[0054] According to a perspective view of an embodiment of a support assembly 134 according to the present disclosure, a support assembly 134 comprises a casing 41 extending along a longitudinal housing direction 3 and comprising at least one resilient member 410 at each of the opposite ends of the casing 41. The support assembly 134 according to the present disclosure further comprises a support element 42 fixedly coupled to the first rail and configured to translate along the longitudinal housing direction 3 and between resilient members 410 from opposite ends of the casing 41. The support element 42 of the support assembly 134 according to the present disclosure comprises an upper portion 421 fitting in one of the slots of the first rail and the upper portion 421 is fixedly coupled to the first rail. The support element 42 of the support assembly 134 according to the present disclosure further comprises a lower portion 422 fixedly coupled to the upper portion 421 and the lower portion 422 fits between two resilient members 410 from opposite ends of the casing 41. The upper portion 421 is configured to translate in the slots of the first rail 131 along the longitudinal housing direction 3. The resilient members 410 extend in the casing 41 along the longitudinal housing direction 3. The resilient members 410 are for example springs. The resilient members 410 are configured to be compressed in the casing 41 by the lower portions 422 when the support elements 42 translate along the longitudinal housing direction 3 until the lower portions 422 come in contact with the resilient members 410. The resilient members 410 are configured to expand in the casing 41 when the lower portions 422 are not in contact with the resilient members 410. The casing 41 according to the present disclosure further comprises an adjusting system 43 at each of the opposite ends of the casing 41, wherein an adjusting system 43 is configured to adjust a length of the resilient members 410 along the longitudinal housing direction 3.

[0055] According to a cross-section of an embodiment of a shading system 1 according to the present disclosure shown in Fig. 3, the shading system 1 for covering an underlying space 2 comprises a housing 11, a plurality of shading blades and a coupling system arranged between the housing 11 and the plurality of shading blades. Components having identical reference numbers than in Fig. 2 fulfil the same functions. The coupling system comprises a first rail 131 and a second rail, both configured to translate along a longitudinal housing direction 3. Each of the shading blades is rotatably coupled to the first rail 131 at a first coupling point and rotatably coupled to the second rail at a second coupling point. The shading system 1 further comprises at least one support assembly 134. The support assembly 134 comprises a casing 41 extending along the longitudinal housing direction 3 and comprising at least one resilient member 410 at each of the opposite ends of the casing 41. The support assembly 134 further comprises a support element 42 fixedly coupled to the first rail 131 and configured to translate along the longitudinal housing direction 3 and between resilient members 410 from opposite ends of the casing 41. The shading system 1 further comprises an actuator 14 which translates the first rail 131 along the longitudinal housing direction 3, thereby triggering a translation of the support elements 42 along the longitudinal housing direction 3 and further triggering a rotation of the shading blades between a closed position wherein the shading blades cover an underlying space 2 and at least one open position. The first rail 131 comprises at least one slot 301 extending along the longitudinal housing direction 3. The support element 42 of the support assembly 134 according to the present disclosure comprises an upper portion 421 fitting in one of the slots 301 of the first rail and the upper portion 421 is fixedly coupled to the first rail. The support element 42 of the support assembly 134 according to the present disclosure further comprises a lower portion 422 fixedly coupled to the upper portion 421 and the lower portion 422 fits between two resilient members 410 from opposite ends of the casing 41. The upper portion 421 is configured to translate in the slots 301 of the first rail along the longitudinal housing direction 3. The resilient members 410 extend in the casing 41 along the longitudinal housing direction 3. The resilient members 410 are for example springs. The resilient members 410 are configured to be compressed in the casing 41 by the lower portions 422 when the support elements 42 translate along the longitudinal housing direction 3 until the lower portions 422 come in contact with the resilient members 410. The resilient members 410 are configured to expand in the casing 41 when the lower portions 422 are not in contact with the resilient members 410. The casing 41 according to the present disclosure further comprises an adjusting system 43 at each of the opposite ends of the casing 41, wherein an adjusting system 43 is configured to adjust a length of the resilient members 410 along the longitudinal housing direction 3.

[0056] According to a perspective view of an embodiment of a shading system 1 according to the present disclosure shown in Fig. 4, the shading system 1 for covering an underlying space 2 comprises a housing 11, a plurality of shading blades and a coupling system arranged between the housing 11 and the plurality of shading blades. Components having identical reference numbers than in Fig. 2 or Fig. 3 fulfil the same functions. The coupling system comprises a first rail 131 and a second rail 132, both configured to translate along a longitudinal housing direction 3. Each of the shading blades is rotatably coupled to the first rail 131 at a first coupling point and rotatably coupled to the second rail 132 at a second coupling point. The shading system 1 further comprises at least one support assembly 134. The support assembly 134 comprises a casing 41 extending along the longitudinal housing direction 3 and comprising at least one resilient member 410 at each of the opposite ends of the casing 41. The support assembly 134 further comprises a support element 42 fixedly coupled to the first rail 131 and configured to translate along the longitudinal housing direction 3 and between resilient members 410 from opposite ends of the casing 41. The shading system 1 further comprises an actuator which translates the first rail 131 along the longitudinal housing direction 3, thereby triggering a translation of the support elements 42 along the longitudinal housing direction 3 and further triggering a rotation of the shading blades between a closed position wherein the shading blades cover an underlying space 2 and at least one open position. The first rail 131 comprises at least one slot 301 extending along the longitudinal housing direction 3. The support element 42 of the support assembly 134 according to the present disclosure comprises an upper portion 421 fitting in one of the slots 301 of the first rail and the upper portion 421 is fixedly coupled to the first rail. The support element 42 of the support assembly 134 according to the present disclosure further comprises a lower portion 422 fixedly coupled to the upper portion 421 and the lower portion 422 fits between two resilient members 410 from opposite ends of the casing 41. The upper portion 421 is configured to translate in the slots 301 of the first rail along the longitudinal housing direction 3. The resilient members 410 extend in the casing 41 along the longitudinal housing direction 3. The resilient members 410 are for example springs. The resilient members 410 are configured to be compressed in the casing 41 by the lower portions 422 when the support elements 42 translate along the longitudinal housing direction 3 until the lower portions 422 come in contact with the resilient members 410. The resilient members 410 are configured to expand in the casing 41 when the lower portions 422 are not in contact with the resilient members 410. The casing 41 according to the present disclosure further comprises an adjusting system 43 at each of the opposite ends of the casing 41, wherein an adjusting system 43 is configured to adjust a length of the resilient members 410 along the longitudinal housing direction 3. The coupling system further comprises a coupling element 133 rotatably coupled to the housing 11 and rotatably coupled to the second rail 132. The coupling element 133 limits a translation of the second rail 132 along the longitudinal housing direction 3, thereby rotating the shading blades 12 between a closed position and at least one open position when the actuator translates the first rail 131 along the longitudinal housing direction 3.

[0057] According to a perspective view of an embodiment of a shading system 1 according to the present disclosure shown in Fig. 5, the shading system 1 for covering an underlying space 2 comprises a housing 11, a plurality of shading blades 12 and a coupling system arranged between the housing 11 and the plurality of shading blades 12. Components having identical reference numbers than in Fig. 2 or Fig. 3 or Fig. 4 fulfil the same functions. The coupling system comprises a first rail 131 and a second rail 132, both configured to translate along a longitudinal housing direction 3. Each of the shading blades is rotatably coupled to the first rail 131 at a first coupling point 121 and rotatably coupled to the second rail 132 at a second coupling point 122. The shading system 1 further comprises at least one support assembly 134. The support assembly 134 comprises a casing 41 extending along the longitudinal housing direction 3 and comprising at least one resilient member 410 at each of the opposite ends of the casing 41. The support assembly 134 further comprises a support element fixedly coupled to the first rail 131 and configured to translate along the longitudinal housing direction 3 and between resilient members from opposite ends of the casing 41. The shading system 1 further comprises an actuator which translates the first rail 131 along the longitudinal housing direction 3, thereby triggering a translation of the support elements along the longitudinal housing direction 3 and further triggering a rotation of the shading blades between a closed position wherein the shading blades cover an underlying space 2 and at least one open position. The first rail 131 comprises at least one slot 301 extending along the longitudinal housing direction 3. The support element of the support assembly 134 according to the present disclosure comprises an upper portion fitting in one of the slots 301 of the first rail 131 and the upper portion is fixedly coupled to the first rail 131. The support element of the support assembly 134 according to the present disclosure further comprises a lower portion fixedly coupled to the upper portion and the lower portion fits between two resilient members from opposite ends of the casing 41. The upper portion is configured to translate in the slots 301 of the first rail 131 along the longitudinal housing direction 3. The resilient members extend in the casing 41 along the longitudinal housing direction 3. The resilient members are for example springs. The resilient members are configured to be compressed in the casing 41 by the lower portions when the support elements translate along the longitudinal housing direction 3 until the lower portions come in contact with the resilient members. The resilient members are configured to expand in the casing 41 when the lower portions are not in contact with the resilient members. The casing 41 according to the present disclosure further comprises an adjusting system 43 at each of the opposite ends of the casing 41, wherein an adjusting system 43 is configured to adjust a length of the resilient members along the longitudinal housing direction 3. The coupling system further comprises a coupling element 133 rotatably coupled to the housing 11 and rotatably coupled to the second rail 132. The coupling element 133 limits a translation of the second rail 132 along the longitudinal housing direction 3, thereby rotating the shading blades 12 between a closed position and at least one open position when the actuator translates the first rail 131 along the longitudinal housing direction 3.

[0058] Fig. 6 schematically illustrates mechanical forces 604 in Newton measured when a shading system according to the present disclosure is in operation, as a function of an angle of opening 602 of the shading blades of the shading systems in degrees. When the angle of opening 602, also referred to as an angle of rotation of the shading blades, is equal to 0, the shading blades are in a closed position wherein the shading blades extend along the longitudinal housing direction of the shading system. When the data points 604 cross with the angle of opening 602, for an angle of 82 degrees on Fig. 6, the shading blades are balanced in an open position, i.e. their centre of gravity is above the first coupling point of the shading blades to the first rail of the shading system. The data points 603 represent the available force which may be generated by an actuator of a shading system according to the present disclosure. For example, on Fig. 6, an actuator may exert a mechanical force of 2.5kN. The data points 604 illustrate the mechanical force exerted by the plurality of shading blades on the first rail of the shading system. The data points 606 illustrate the mechanical force exerted on the first rail of the shading system in a direction opposite to the direction of translation of the first rail when the shading blades are rotated. The data points 605 illustrate the difference between the mechanical force exerted by the plurality of shading blades on the first rail of the shading system and the mechanical force exerted on the first rail of the shading system in a direction opposite to the direction of translation of the first rail when the shading blades are rotated; in other words, the data points 605 illustrate the mechanical force which must be exerted by the actuator of the shading system. It is clear from Fig. 6 that the mechanical force exerted on the first rail of the shading system in a direction opposite to the direction of translation of the first rail when the shading blades are rotated, represented by the data points 606, should be kept as close as possible to the mechanical force exerted by the plurality of shading blades on the first rail of the shading system, illustrated by the data points 604. It is also clear from Fig. 6 that the mechanical force which must be exerted by the actuator of the shading system, represented by the data points 605, should be kept as low as possible below the available force which may be generated by an actuator of the shading system, illustrated by the data points 603. As visible on Fig. 6, both conditions are fulfilled with a shading system according to the present disclosure.

[0059] According to a cross-section of an embodiment shown in Fig. 7, a shading system 1 for covering an underlying space 2 according to the present invention comprises a housing 11, a plurality of shading blades 12, a coupling system and an actuator. Components having identical reference numbers than in Fig. 2 or Fig. 3 or Fig. 4 or Fig. 5 fulfil the same functions. The shading system 1 is symmetric with respect to the plurality of shading blade 12 along the longitudinal blade direction 4. The housing 11 extends along a longitudinal housing direction 3. The shading blades 12 are arranged one after the other along the longitudinal housing direction 3, each of the shading blades 12 extending along a longitudinal blade direction 4 traverse to the longitudinal housing direction 3. The shading blades 12 are being movable between a closed position 6 in which the shading blades 12 cover the underlying space 2 and at least one open position. The coupling system is arranged between the housing 11 and the plurality of shading blades 12. The coupling system comprises a first rail 131, a second rail 132 and a coupling element 133. The first rail 131 extends along the longitudinal housing direction 3 and the first rail 131 translates along the longitudinal housing direction 3. The second rail 132 extends along the longitudinal housing direction 3. Each of the shading blades 12 is rotatably coupled to the first rail 131 at a first coupling point 121 and each of the shading blades 12 is also rotatably coupled to the second rail 132 at a second coupling point 122. Each of the shading blades 12 comprises a first rotating pin which fits in a respective recess of the first rail 131 at the respective first coupling point 121 such that the respective shading blade 12 can rotate around a first rotation axis at the first coupling point 121. Additionally, each of the shading blades 12 comprises a second rotating pin which is coupled to the second rail 132 at the respective second coupling point 122 such that the respective shading blade 12 can rotate around a second rotation axis at the second coupling point 122. The coupling element 133 is rotatably coupled to the housing 11 and the coupling element 133 is also rotatably coupled to the second rail 132. The actuator translates the first rail 131 along the longitudinal housing direction 3. The coupling element 133 limits a translation of the second rail 132 along the longitudinal housing direction 3, thereby rotating the shading blades 12 between the closed position 6 and at least one of the open positions. The shading system 1 further comprises a rain gutter 15 extending along the longitudinal housing direction 3 and arranged below the plurality of shading blades 12. The rain gutter 15 comprises a rain gutter coupling element 151 which couples the rain gutter 15 to the housing 11 and a protecting element 152 which extends along the longitudinal housing direction 3. The protecting element 152 is arranged traverse to the longitudinal blade direction 4 such that the shading blades 12 partially overlap with the rain gutter 15 along the longitudinal blade direction 4. Each of the shading blades 12 comprises a strip and a blade holder. Each strip extends along the longitudinal blade direction 4, and each strip comprises the second coupling point 122 of the respective shading blade 12. Each blade holder comprises a blade holder body, a first blade holder tip and a second blade holder tip. Each blade holder body supports the strip along the longitudinal blade direction 4. Each first blade holder tip comprises the first coupling point 121 of the respective shading blade 12. Each second blade holder tip is arranged opposite each respective first blade holder tip. The shading blades 12 rotate at their first coupling points 121 around a first rotation axis extending along the longitudinal blade direction 4. The shading blades 12 also rotate at their second coupling points 122 around a second rotation axis extending along the longitudinal blade direction 4. The first rail 131 comprises a holder and a guide. The holder extends along the longitudinal housing direction 3 and is connected to each of the blade holders 222 at each of the first coupling points 121. The holder comprises at least one pair of wheels which can translate along the longitudinal housing direction 3. The guide is coupled to the holder. The guide extends along the longitudinal housing direction 3 and the guide is coupled to the housing 11. The guide guides the pair of wheels along the longitudinal housing direction 3. The actuator is coupled to the holder and thereby translates the holder of the first rail 131. The protecting element 152 of the rain gutter 15 may optionally further comprise a brush 50 which extends along the longitudinal housing direction 3. The brush 50 is arranged such that each of the blade holders 222 lies onto the brush 50 when the shading blades 12 are in a closed position. The coupling element 133 is for example a rod. When the coupling element 133 limits the translation of the second rail 132 along the longitudinal housing direction 3, the second rail 132 moves along a traverse direction 5 traverse to the longitudinal housing direction 3 and to the longitudinal blade direction

4. The first rail 131 extends along the longitudinal housing direction 3. In other words, the first rail 131 comprises a first longitudinal axis along the longitudinal housing direction 3. The second rail 132 extends along the longitudinal housing direction 3. In other words, the second rail 132 comprises a second longitudinal axis along the longitudinal housing direction 3. The shading system 1 further comprises at least one support assembly 134. The support assembly 134 comprises a casing 41 extending along the longitudinal housing direction 3 and comprising at least one resilient member 410 at each of the opposite ends of the casing 41. The support assembly 134 further comprises a support element fixedly coupled to the first rail 131 and configured to translate along the longitudinal housing direction 3 and between resilient members from opposite ends of the casing 41. The first rail 131 comprises at least one slot 301 extending along the longitudinal housing direction 3. The support element of the support assembly 134 according to the present disclosure comprises an upper portion fitting in one of the slots 301 of the first rail 131 and the upper portion is fixedly coupled to the first rail 131. The support element of the support assembly 134 according to the present disclosure further comprises a lower portion fixedly coupled to the upper portion and the lower portion fits between two resilient members from opposite ends of the casing 41. The upper portion is configured to translate in the slots 301 of the first rail 131 along the longitudinal housing direction 3. The resilient members extend in the casing 41 along the longitudinal housing direction 3. The resilient members are for example springs. The resilient members are configured to be compressed in the casing 41 by the lower portions when the support elements translate along the longitudinal housing direction 3 until the lower portions come in contact with the resilient members. The resilient members are configured to expand in the casing 41 when the lower portions are not in contact with the resilient members. The casing 41 according to the present disclosure further comprises an adjusting system 43 at each of the opposite ends of the casing 41, wherein an adjusting system 43 is configured to adjust a length of the resilient members along the longitudinal housing direction 3.

[0060] According to a side view of an embodiment shown in Fig. 8A and Fig. 8B, a shading system 1 for covering an underlying space 2 according to the present invention comprises a housing 11, a plurality of shading blades 12, a coupling system and an actuator. Components having identical reference numbers than in Fig. 2 or Fig. 3 or Fig. 4 or Fig. 5 or Fig. 7 fulfil the same functions. The shading system 1 is symmetric with respect to the plurality of shading blade 12 along the longitudinal blade direction 4. The housing 11 extends along a longitudinal housing direction 3. The shading blades 12 are arranged one after the other along the longitudinal housing direction 3, each of the shading blades 12 extending along a longitudinal blade direction 4 traverse to the longitudinal housing direction 3. The shading blades 12 are being movable between a closed position 6 depicted in Fig. 8B in which the shading blades 12 cover the underlying space 2 and at least one open position depicted in Fig. 8A. The coupling system is arranged between the housing 11 and the plurality of shading blades 12. The coupling system comprises a first rail 131, a second rail 132 and a coupling element 133. The first rail 131 extends along the longitudinal housing direction 3 and the first rail 131 translates along the longitudinal housing direction 3. The second rail 132 extends along the longitudinal housing direction 3. Each of the shading blades 12 is rotatably coupled to the first rail 131 at a first coupling point 121 and each of the shading blades 12 is also rotatably coupled to the second rail 132 at a second coupling point 122. Each of the shading blades 12 comprises a first rotating pin which fits in a respective recess of the first rail 131 at the respective first coupling point 121 such that the respective shading blade 12 can rotate around a first rotation axis at the first coupling point 121. Additionally, each of the shading blades 12 comprises a second rotating pin which is coupled to the second rail 132 at the respective second coupling point 122 such that the respective shading blade 12 can rotate around a second rotation axis at the second coupling point 122. The coupling element 133 is rotatably coupled to the housing 11 and the coupling element 133 is also rotatably coupled to the second rail 132. The actuator translates the first rail 131 along the longitudinal housing direction 3. The coupling element 133 limits a translation of the second rail 132 along the longitudinal housing direction 3, thereby rotating the shading blades 12 between the closed position 6 and at least one of the open positions. The shading system 1 further comprises a rain gutter 15 extending along the longitudinal housing direction 3 and arranged below the plurality of shading blades 12. The rain gutter 15 comprises a rain gutter coupling element 151 which couples the rain gutter 15 to the housing 11 and a protecting element 152 which extends along the longitudinal housing direction 3. The protecting element 152 is arranged traverse to the longitudinal blade direction 4 such that the shading blades 12 partially overlap with the rain gutter 15 along the longitudinal blade direction 4. Each of the shading blades 12 comprises a strip and a blade holder. Each strip extends along the longitudinal blade direction 4, and each strip comprises the second coupling point 122 of the respective shading blade 12. Each blade holder comprises a blade holder body, a first blade holder tip and a second blade holder tip. Each blade holder body supports the strip along the longitudinal blade direction 4. Each first blade holder tip comprises the first coupling point 121 of the respective shading blade 12. Each second blade holder tip is arranged opposite each respective first blade holder tip. The shading blades 12 rotate at their first coupling points 121 around a first rotation axis extending along the longitudinal blade direction 4. The shading blades 12 also rotate at their second coupling points 122 around a second rotation axis extending along the longitudinal blade direction 4. The first rail 131 comprises a holder and a guide. The holder extends along the longitudinal housing direction 3 and is connected to each of the blade holders 222 at each of the first coupling points 121. The holder comprises at least one pair of wheels which can translate along the longitudinal housing direction 3. The guide is coupled to the holder. The guide extends along the longitudinal housing direction 3 and the guide is coupled to the housing 11. The guide guides the pair of wheels along the longitudinal housing direction 3. The actuator is coupled to the holder and thereby translates the holder of the first rail 131. The protecting element 152 of the rain gutter 15 may optionally further comprise a brush which extends along the longitudinal housing direction 3. The brush is arranged such that each of the blade holders 222 lies onto the brush when the shading blades 12 are in a closed position. The coupling element 133 is for example a rod. When the coupling element 133 limits the translation of the second rail 132 along the longitudinal housing direction 3, the second rail 132 moves along a traverse direction 5 traverse to the longitudinal housing direction 3 and to the longitudinal blade direction 4. The first rail 131 extends along the longitudinal housing direction 3. In other words, the first rail 131 comprises a first longitudinal axis along the longitudinal housing direction 3. The second rail 132 extends along the longitudinal housing direction 3. In other words, the second rail 132 comprises a second longitudinal axis along the longitudinal housing direction 3. The shading system 1 further comprises at least one support assembly. The support assembly comprises a casing extending along the longitudinal housing direction 3 and comprising at least one resilient member at each of the opposite ends of the casing. The support assembly further comprises a support element fixedly coupled to the first rail 131 and configured to translate along the longitudinal housing direction 3 and between resilient members from opposite ends of the casing. The first rail 131 comprises at least one slot 301 extending along the longitudinal housing direction 3. The support element of the support assembly according to the present disclosure comprises an upper portion fitting in one of the slots 301 of the first rail 131 and the upper portion is fixedly coupled to the first rail 131. The support element of the support assembly according to the present disclosure further comprises a lower portion fixedly coupled to the upper portion and the lower portion fits between two resilient members from opposite ends of the casing. The upper portion is configured to translate in the slots 301 of the first rail 131 along the longitudinal housing direction 3. The resilient members extend in the casing along the longitudinal housing direction 3. The resilient members are for example springs. The resilient members are configured to be compressed in the casing by the lower portions when the support elements translate along the longitudinal housing direction 3 until the lower portions come in contact with the resilient members. The resilient members are configured to expand in the casing when the lower portions are not in contact with the resilient members. The casing according to the present disclosure further comprises an adjusting system at each of the opposite ends of the casing, wherein an adjusting system is configured to adjust a length of the resilient members along the longitudinal housing direction 3.

[0061] Although the present disclosure has been illustrated by reference to specific embodiments, it will be apparent to those skilled in the art that the disclosure is not limited to the details of the foregoing illustrative embodiments, and that the present disclosure may be embodied with various changes and modifications without departing from the scope thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the disclosure being indicated by the appended claims rather than by the foregoing description, and all changes which come within the scope of the claims are therefore intended to be embraced therein.

[0062] It will furthermore be understood by the reader of this patent application that the words "comprising" or "comprise" do not exclude other elements or steps, that the words "a" or "an" do not exclude a plurality, and that a single element, such as a computer system, a processor, or another integrated unit may fulfil the functions of several means recited in the claims. Any reference signs in the claims shall not be construed as limiting the respective claims concerned. The terms "first", "second", third", "a", "b", "c", and the like, when used in the description or in the claims are introduced to distinguish between similar elements or steps and are not necessarily describing a sequential or chronological order. Similarly, the terms "top", "bottom", "over", "under", and the like are introduced for descriptive purposes and not necessarily to denote relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and embodiments of the disclosure can operate according to the present disclosure in other sequences, or in orientations different from the one(s) described or illustrated above.

Claims

1. A shading system (1) for covering an underlying space (2), the shading system (1) comprising:

- a housing (11) extending along a longitudinal housing direction (3);
- a plurality of shading blades (12) being movable between a closed position (6) thereby covering the underlying space (2), and at least one open position (7);
- a coupling system arranged between the housing (11) and the plurality of shading blades (12), wherein the coupling system comprises:
    - ◦ a first rail (131) and a second rail (132),

both configured to translate along the longitudinal housing direction (3); wherein each of the shading blades (12) is rotatably coupled to the first rail (131) and rotatably coupled to the second rail (132);

◦ at least one support assembly (134), wherein each support assembly (134) comprises:

▪ a casing (41) extending along the longitudinal housing direction (3) and comprising at least one resilient member (410) at each of the opposite ends of the casing (41); and

▪ a support element (42) fixedly coupled to the first rail (131) and configured to translate along the longitudinal housing direction (3) and between resilient members (410) from opposite ends of the casing (41);

- an actuator (14) configured to translate the first rail (131) along the longitudinal housing direction (3), thereby triggering a translation of the support elements (42) along the longitudinal housing direction (3) and further triggering a rotation of the shading blades (12) between the closed position (6) and the at least one open position (7).

2. The shading system (1) according to claim 1, wherein the first rail (131) comprises at least one slot (301) extending along the longitudinal housing direction (3); and wherein the support elements (42) each comprise:

- an upper portion (421) fitting in one of the slots (301) and fixedly coupled to the first rail (131); and
- a lower portion (422) fixedly coupled to the upper portion (421) and fitting between two resilient members (410) from opposite ends of the casing (41).

3. The shading system (1) according to claim 2, wherein the upper portions (421) are configured to translate in the slots (301) along the longitudinal housing direction (3).

4. The shading system (1) according to any of the preceding claims, wherein the resilient members (410) extend in the casing (41) along the longitudinal housing direction (3).

5. The shading system (1) according to any of the preceding claims, wherein the resilient members (410) are springs.

6. The shading system (1) according to any of the claims 2 to 5, wherein the resilient members (410) are configured to be compressed in the casing (41) by the lower portions (422) when the support elements (42) translate along the longitudinal housing direction (3) until they come in contact with the resilient members (410); and wherein the resilient members (410) are configured to be expand in the casing (41) when the lower portions (422) are not in contact with the resilient members (410).

7. The shading system (1) according to any of the preceding claims, wherein the casing (41) further comprises an adjusting system (43) at each of the opposite ends of the casing (41), wherein an adjusting system (43) is configured to adjust a length of the resilient members (410) along the longitudinal housing direction (3).

8. The shading system (1) according to any of the claims 2 to 7, wherein:

- the shading blades (12) are arranged one after the other along the longitudinal housing direction (3), each of the shading blades (12) extending along a longitudinal blade direction (4) traverse to the longitudinal housing direction (3);
- each of the shading blades (12) is rotatably coupled to the first rail (131) at a first coupling point (121) and rotatably coupled to the second rail (132) at a second coupling point (122); and
- the slots (301) are under the first coupling points (121) along a direction traverse to the longitudinal housing direction (3) and to the longitudinal blade direction (4).

9. The shading system (1) according to any of the preceding claims, wherein the coupling system further comprises a coupling element (133) rotatably coupled to the housing (11) and rotatably coupled to the second rail (132); wherein the coupling element (133) limits a translation of the second rail (132) along the longitudinal housing direction (3), thereby rotating the shading blades (12) between the closed position (6) and the at least one open position (7) when the actuator (14) translates the first rail (131) along the longitudinal housing direction (3).

10. The shading system (1) according to any of the preceding claims, wherein the shading system (1) further comprises a rain gutter (15) extending along the longitudinal housing direction (3) and arranged below the plurality of shading blades (12).

11. A shading system (1) according to claim 10, wherein the rain gutter (15) comprises a rain gutter coupling element (151) adapted to couple the rain gutter (15) to the housing (11) and a protecting element (152) extending along the longitudinal housing direction (3); wherein the protecting element (152) is arranged traverse to the longitudinal blade direction (4) such that shading blades (12) partially overlap the rain gutter (15) along the longitudinal blade direction (4).

12. A shading system (1) according to any of the preceding claims, wherein each of the shading blades (12) comprises:

- a strip (221) extending along the longitudinal blade direction (4), wherein the strip (221) comprises the second coupling point (122); and
- a blade holder (222) comprising:
    - ◦ a blade holder body (223) configured to support the strip (221) along the longitudinal blade direction (4);
    - ◦ a first blade holder tip (224) comprising the first coupling point (121); and
    - ◦ a second blade holder tip (225) opposite the first blade holder tip (224).

13. A shading system (1) according to any of the claims 10 to 12, wherein when the shading blades (12) are in the closed position (6), the shading blades (12) are arranged partially superimposed, each over the next, with the second blade holder tip (225) of a shading blade (12) partially superimposing the first blade holder tip (224) of the next shading blade (12) along the longitudinal housing direction (4); and wherein when the shading blades (12) are in the open position (7), the shading blades (12) are arranged each spaced from the next by an opening formed between the second blade holder tip (225) of a shading blade (12) and the first blade holder tip (224) of the next shading blade (12) along the longitudinal housing direction (4).

14. A shading system (1) according to claims , wherein the protecting element (152) of the rain gutter (15) comprises a brush (50) extending along the longitudinal housing direction (3); wherein the brush (50) is arranged such that each of the blade holders (222) lies onto the brush (50) in the closed position (6).

15. A method for covering an underlying space (2), the method comprising the steps of:

- providing a housing (11) extending along a longitudinal housing direction (3);
- providing a plurality of shading blades (12);
- arranging the shading blades (12) such that the shading blades (12) are movable between a closed position (6) thereby covering the underlying space (2), and at least one open position (7);
- providing a coupling system arranged between the housing (11) and the plurality of shading blades (12), wherein the providing a coupling system comprises:
    - ◦ providing a first rail (131) and a second rail (132), both configured to translate along the longitudinal housing direction (3); wherein each of the shading blades (12) is rotatably coupled to the first rail (131) and rotatably coupled to the second rail (132);
    - ◦ providing at least one support assembly (134), wherein each support assembly (134) comprises:
        - ▪ a casing (41) extending along the longitudinal housing direction (3) and comprising at least one resilient member (410) at each of the opposite ends of the casing (41); and
        - ▪ a support element (42) fixedly coupled to the first rail (131) and configured to translate along the longitudinal housing direction (3) and between resilient members (410) from opposite ends of the casing (41);
- translating the first rail (131) along the longitudinal housing direction (3); thereby triggering a translation of the support elements (42) along the longitudinal housing direction (3) and further triggering a rotation of the shading blades (12) between the closed position (6) and the at least one open position (7).

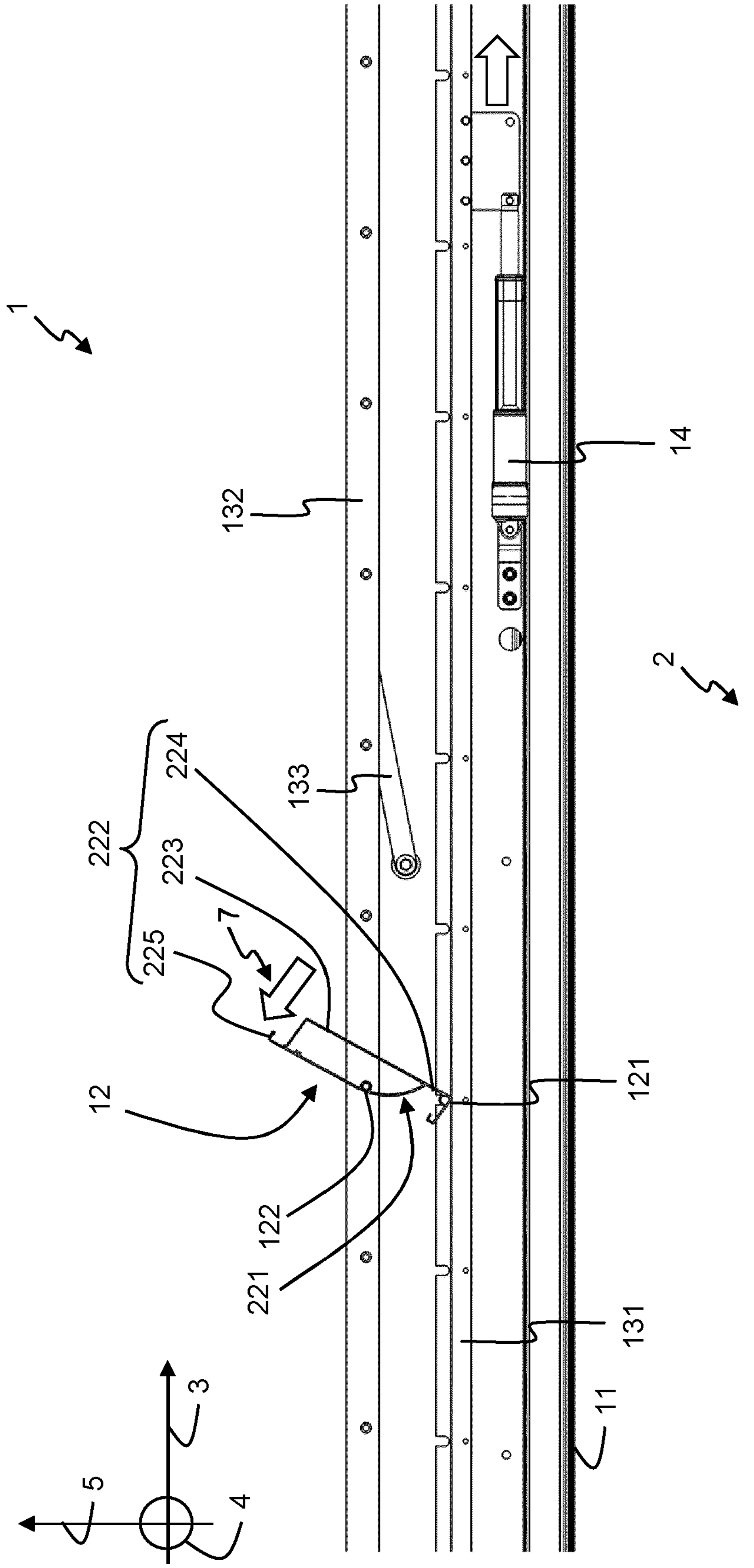

Fig. 1A (PRIOR ART)

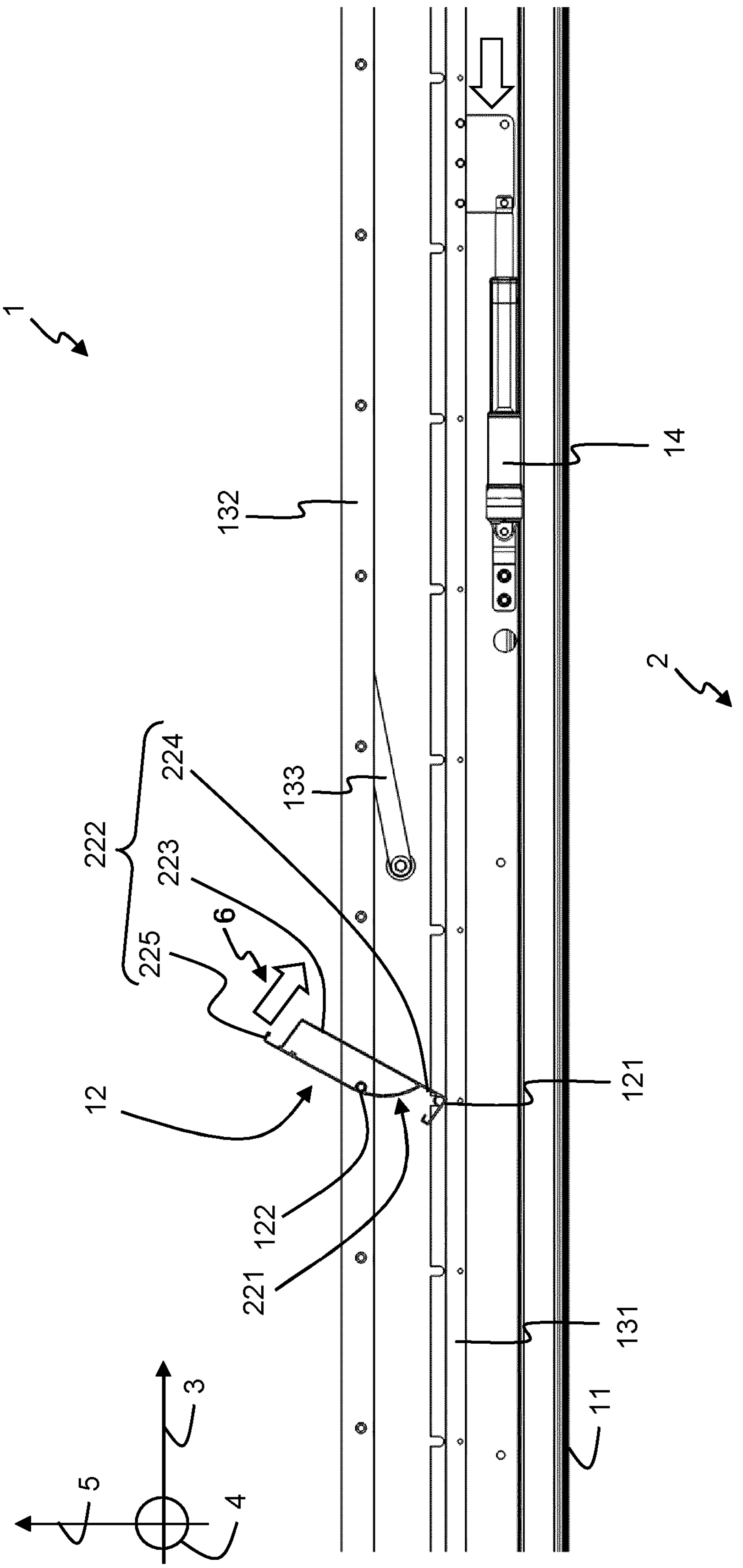

Fig. 1B (PRIOR ART)

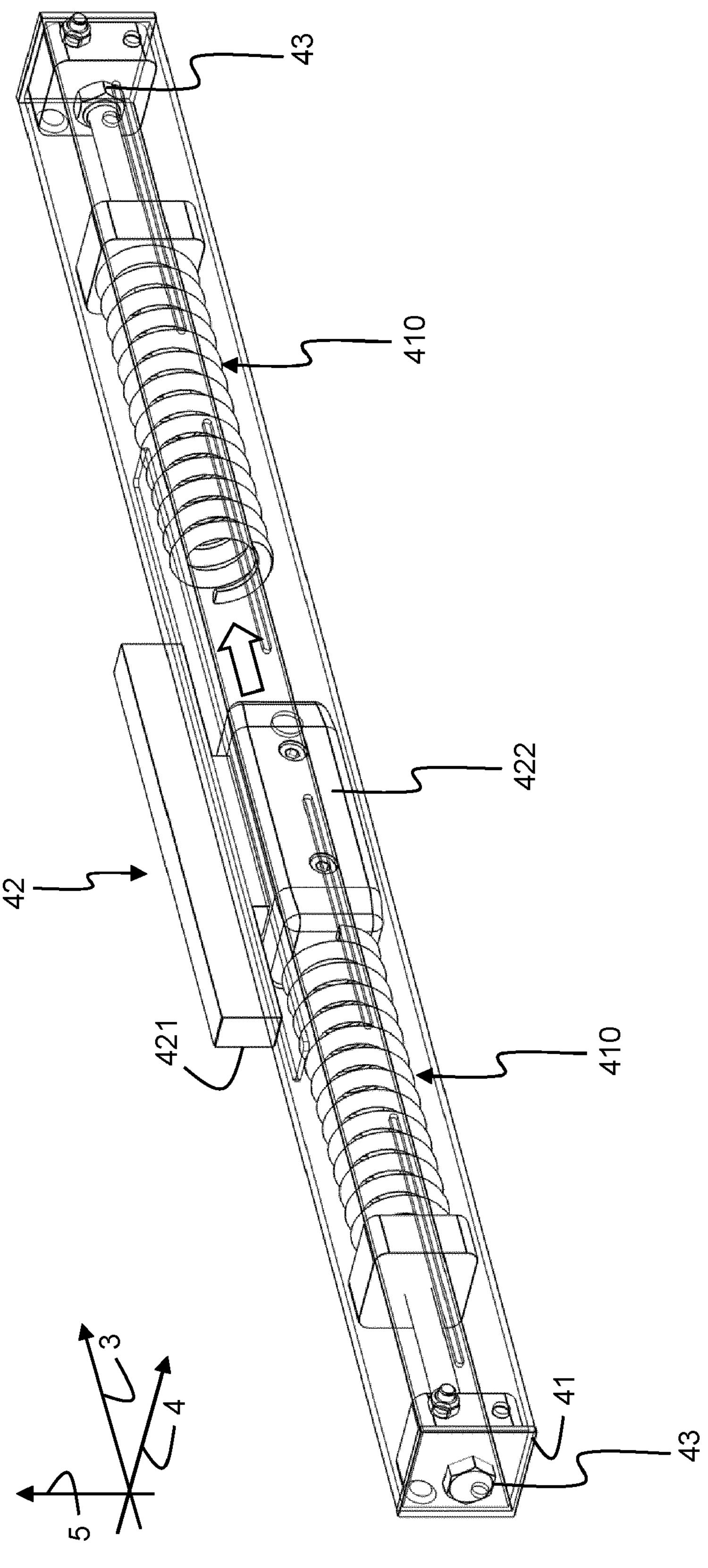

Fig. 2

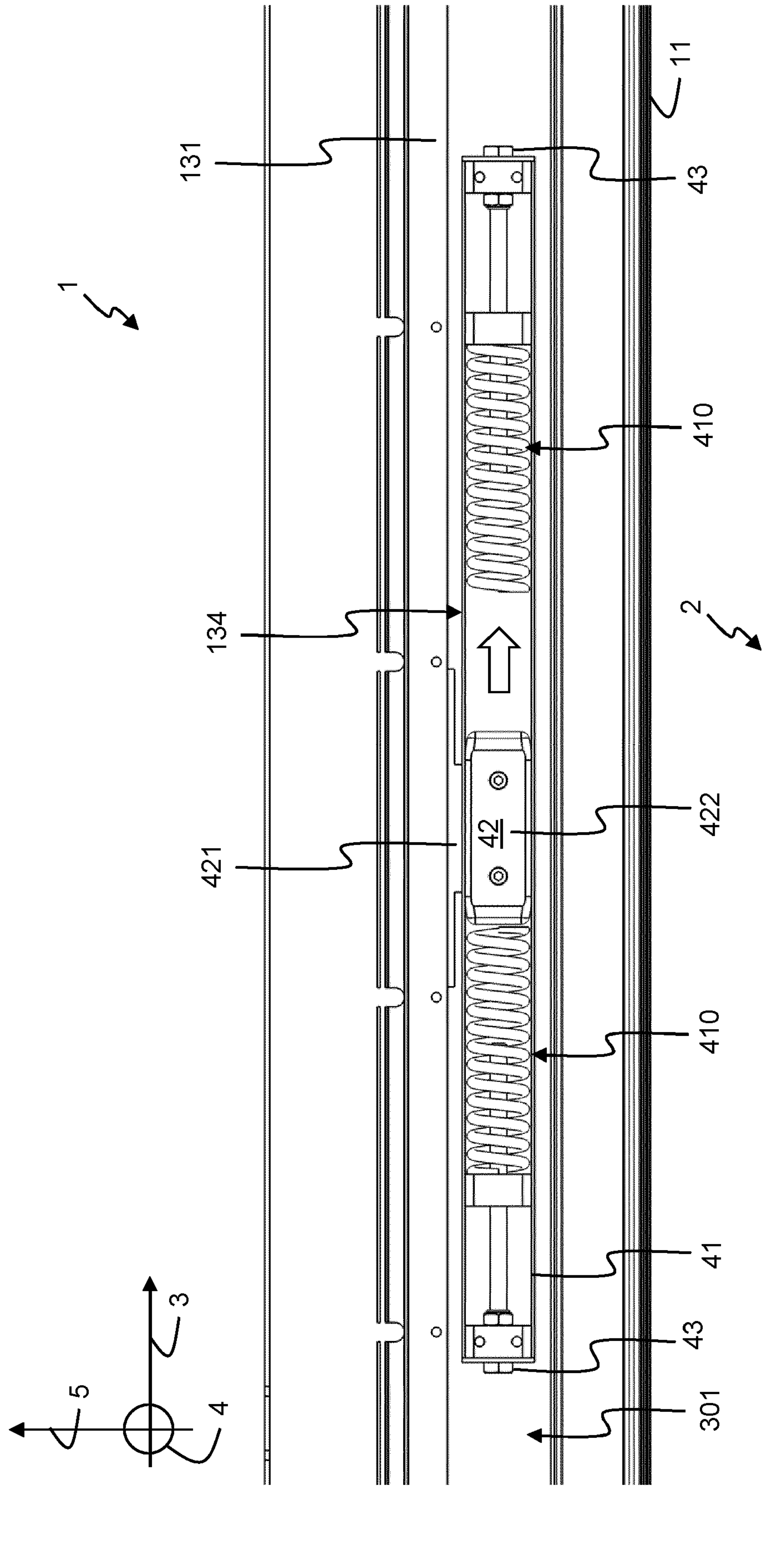

Fig. 3

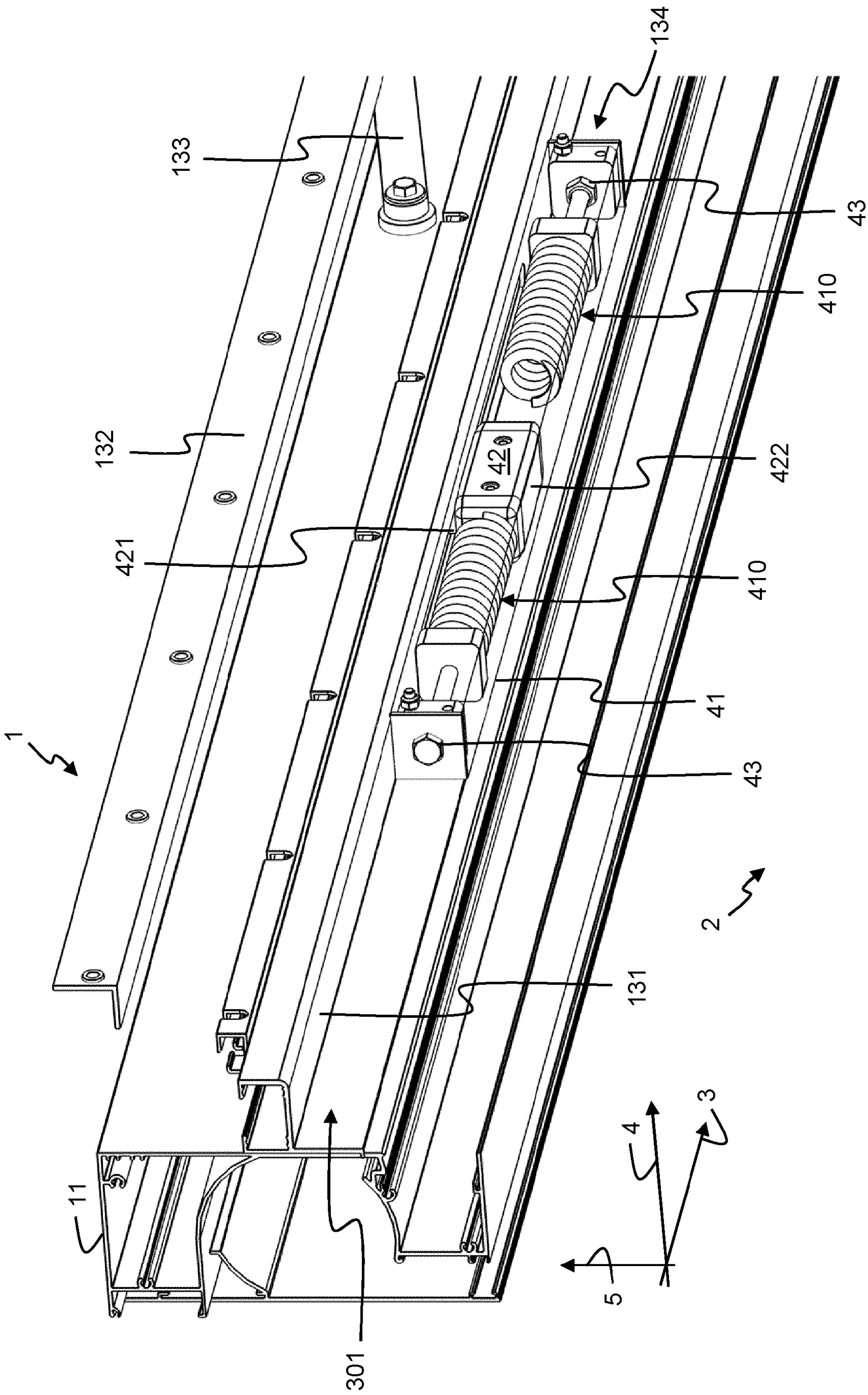

Fig. 4

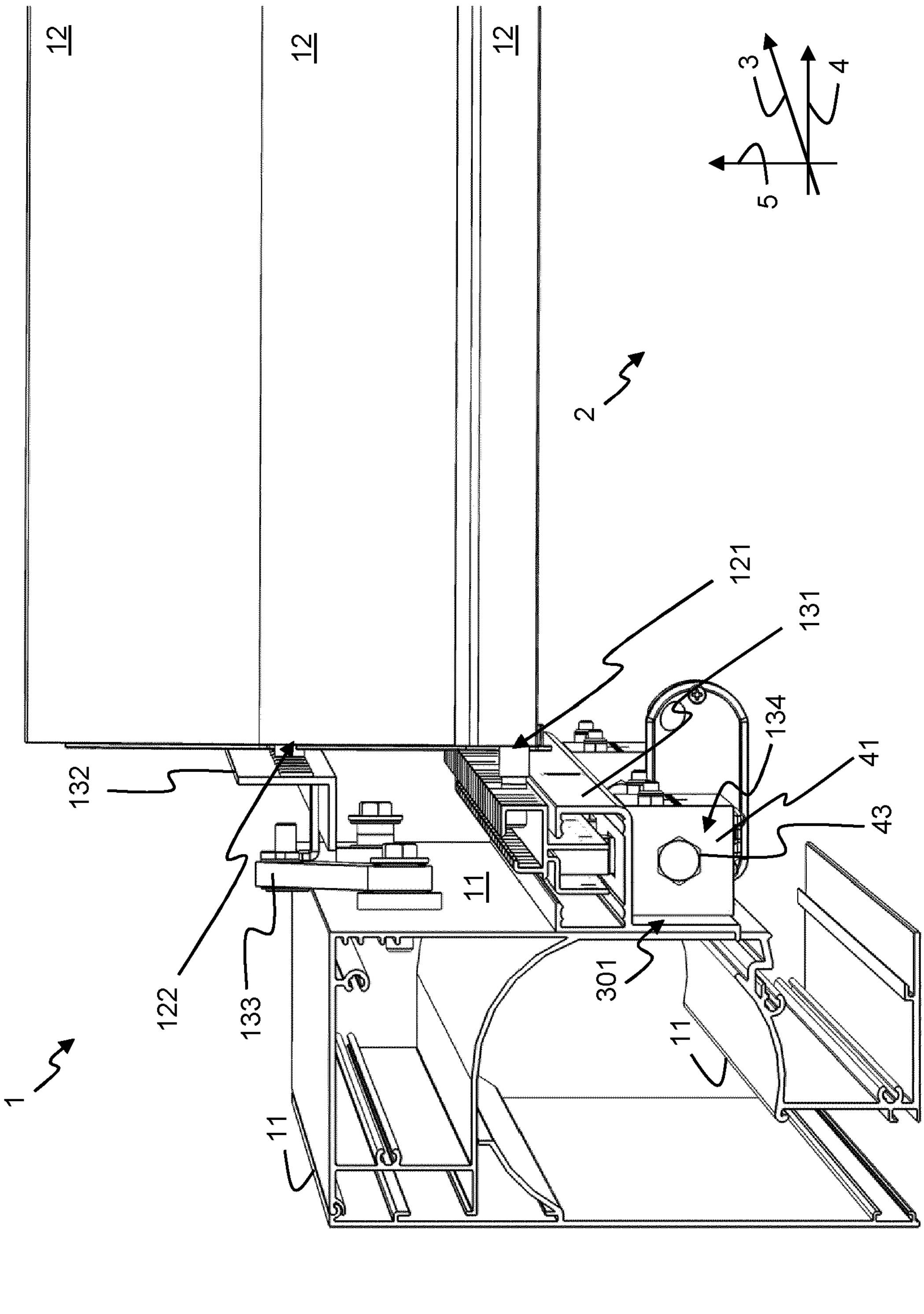

Fig. 5

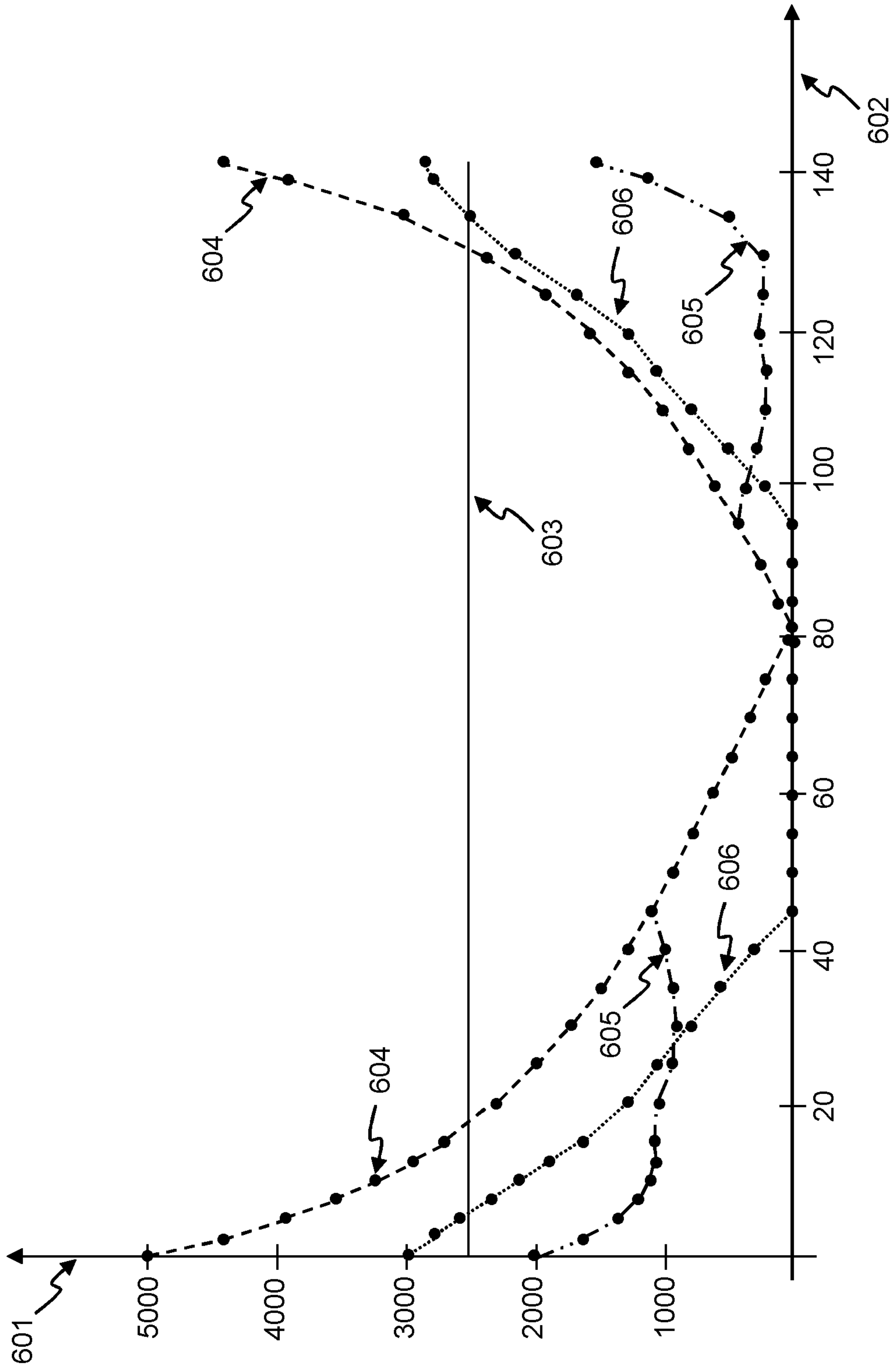
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Fig. 6

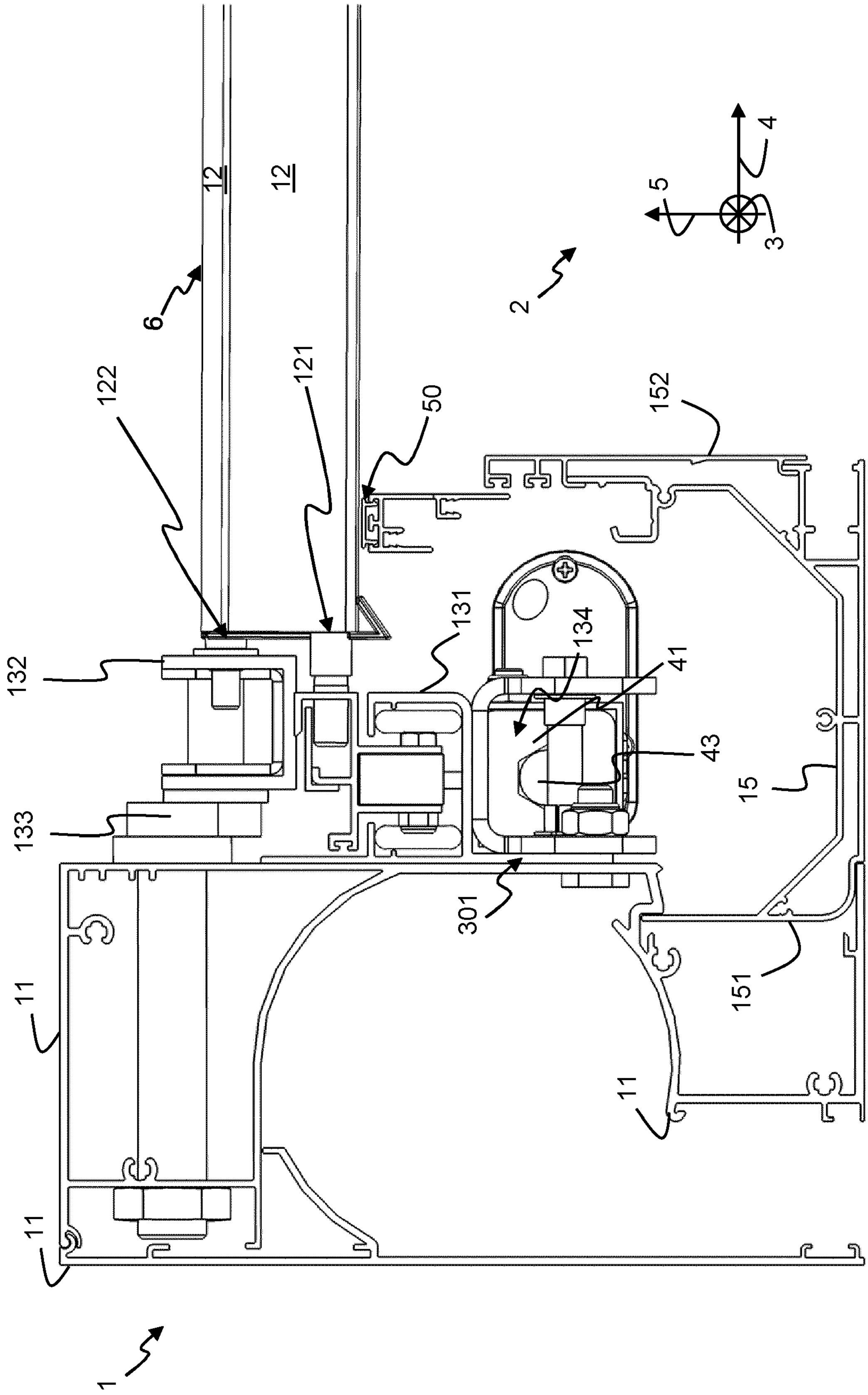
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Fig. 7

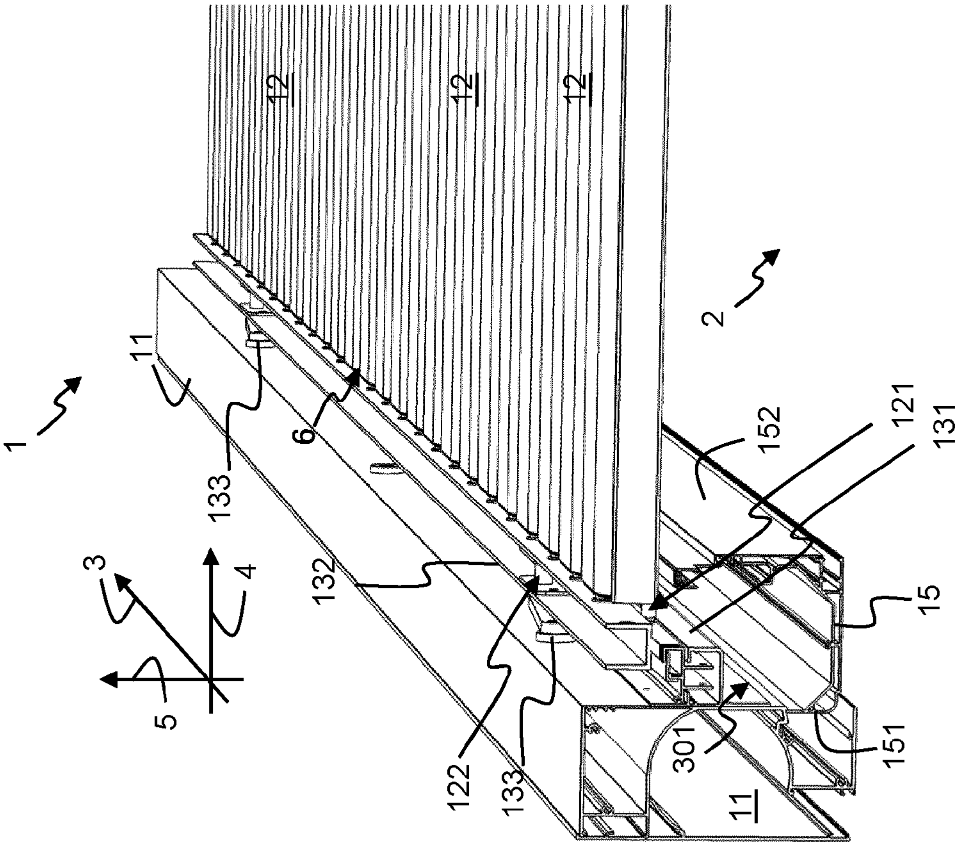
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Fig. 8B

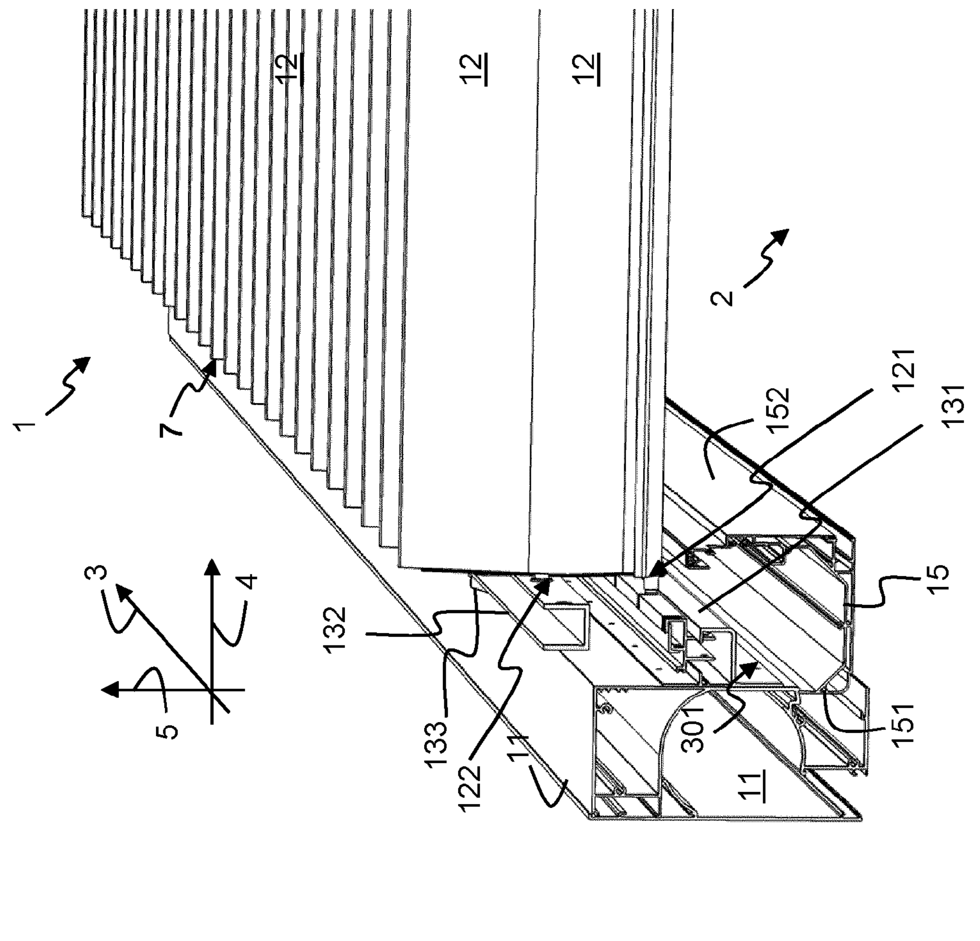
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Fig. 8A

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EUROPEAN SEARCH REPORT

Application Number
EP 22 20 7809

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The present search report has been drawn up for all claims

2

Place of search	Date of completion of the search	Examiner
Munich	17 May 2023	Topcuoglu, Sadik Cem

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EUROPEAN SEARCH REPORT

Application Number
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