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(54) Arrangement at a glazed-in balcony

(57) The present invention relates to an arrangement at displaceable and outwards/inwards turnable shutters, preferably glass shutters, comprising at least one displaceable shutter (L_1), wherein a link arrangement (12) is used comprising at least one pivot pin (123) which is arranged to protrude at a distance from the steering wall portions (129) of the body (120) of said link arrangement (12), preferably positioned on or adjacent to the centre line of the longitudinal link space (128) defined by said steering wall portions (12) and that said shutter has a steering/turning means (10) provided with a steering/turning body (102) with a through groove (104) adapted to accommodate said pivot pin (123).

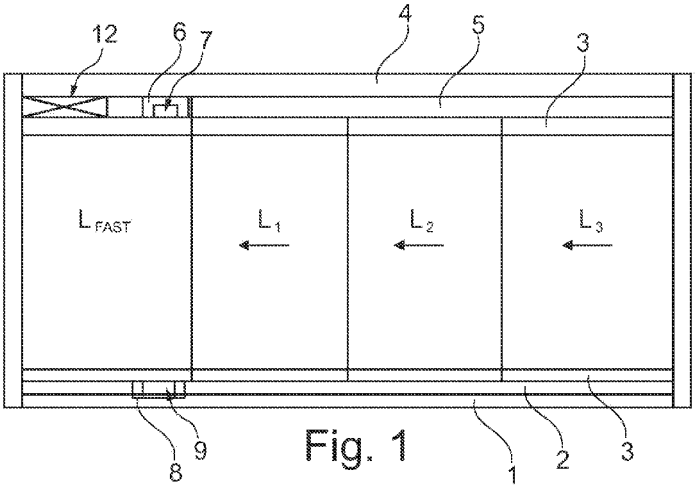

Fig. 1

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Description

TECHNICAL FIELD

[0001] An arrangement with displaceable and inwards/outwards turnable shutters, preferably glass shutters, comprising at least one displaceable shutter, with steering/turning means at its upper side and sliding/turning means at its bottom side, an upper steering/skid rail with a downwards open, longitudinal slot, and an inner longitudinal space in connection to the slot, a lower steering/skid rail with an upwards open, longitudinal slot, and an inner longitudinal space in connection to the slot with sliding surfaces in the bottom portion, wherein the upper steering/turning means are arranged to be displaced along the upper steering/skid rail, and the lower steering/sliding means are arranged to be displaced along the lower steering/skid rail, and inside said upper skid rail or in a direct connection thereto a link arrangement with steering wall portions is provided to permit in/out-turning of said displaceable shutter, in at least one position.

PRIOR ART

[0002] Glazed-in systems are generally used to shield, for instance balconies and verandas from wind, noice and cold. Typically, a plurality of glass panes are placed side by side round the balcony space on some type of a sliding device to enable horizontal movement. In this way, the plurality of glass panes may be moved to one side of the balcony and be placed with their respective planes towards each other. Often, the glass panes may also be pivoted about a vertical axis so that they may be folded towards one side of the balcony/veranda, which saves space and enables a flexible, temporary storage, e.g. during warm periods, and it also permits simple window cleaning.

[0003] An example of a foldable glazed-in system is shown in the Swedish patent application SE9100636-1, where glass panels are foldable through a hinge construction at one upper corner of each panel, whereby several panels may be pivoted to a folded position and attached to one side of the balcony. An additional example of a similar mechanism is shown in DE10002214, where folding of the panels is permitted through a pivot system at the upper corner of the respective glass panel.

[0004] The present solutions involve certain drawbacks. During the turning of a glass pane it obviously is important that this does not slide out of its position and fall down onto the balcony/veranda and run the risk to damage persons and/or objects. For this reason, a steering arm is often used hindering the glass panels from falling during the folding operation, until they are safely locked in an upright position. This procedure often is somewhat circumstantial and in addition the steering arm requires space and is in the way for curtains and Venetian blinds.

[0005] For this and other reasons it is desirable with a new steering system for glass panels which permits safe, flexible and rapid relocation of the panels and at the same time avoids large and bulky equipment.

DISCLOSURE OF THE INVENTION

[0006] The object of the present invention is to eliminate or at least minimize the problems mentioned above, which is achieved with a solution in accordance with the claims.

[0007] Thanks to the invention, a constructional solution is obtained which drastically admits improved precision in the arrangement of the turning link steering and supporting a sliding shutter in connection with folding, which in its turn implies the great advantage that the use of additional steering means, like lifting arms (which is used according to known concepts) may be entirely eliminated. The invention implies that the construction may be made more fashionable, safer, less expensive, more resistant and considerably easier to use.

[0008] Additional advantages and aspects of the invention will be apparent of the following detailed description.

BRIEF DESCRIPTION OF DRAWINGS

[0009] Below the invention will be described more in detail with reference to the drawings showing an embodiment, of which:

- Fig. 1 schematically shows an assembly of included details for a sliding glazed-in wall according to the invention, seen from the side;
- Fig. 2 schematically shows the principles how the glazed-in wall may be changed to a folded condition;
- Fig. 3 schematically shows a glass shutter part according to the invention, seen from the side;
- Fig. 4 shows a cross-section of a lower attachment profile according to an embodiment of the invention;
- Fig. 5 shows a cross-section of a lower skid rail profile according to an embodiment of the invention;
- Fig. 6 shows a cross-section of a profile of a glass attachment according to a preferred embodiment of the invention, which is intended to be used both at the top and at the bottom around a glass included in a shutter;
- Fig. 7 shows a first side view of a sliding and link element according to an embodiment of the invention;

Fig. 8 shows the detail of Fig. 7 seen from below;

Fig. 9 shows the same details seen from a side view which is 90° in relation to Fig. 7;

Fig. 10 shows the same details as in Fig. 7 seen from above;

Fig. 11 shows a side view of a sliding and steering device according to a preferred embodiment of the invention, seen from the side;

Fig. 12 shows the same detail as Fig. 11, also from the side but turned 90°;

Fig. 13 shows a cross-section of an upper skid rail profile according to a preferred embodiment of the invention;

Fig. 14 shows a cross-section of a attachment profile according to a preferred embodiment of the invention;

Fig. 15 shows a perspective view, seen obliquely from above, of a link arrangement according to a preferred embodiment of the invention;

Fig. 16 shows the same details as Fig. 15, seen in perspective from below;

Fig. 17 shows the link arrangement, seen from above;

Fig. 18 shows the link arrangement, seen from the long side;

Fig. 19 shows the link arrangement, seen from one short side;

Fig. 20 shows the link arrangement, seen from below;

Fig. 21 shows a cross-section of the link arrangement in Fig. 20, taken along the line A-A;

Fig. 22 shows a cross-section of the link arrangement, taken along the line B-B in Fig. 20;

Fig. 23 shows a cross-section, taken along the line C-C in Fig. 20; and

Fig. 24 shows a cross-section, taken along the line D-D in Fig. 20.

DETAILED DESCRIPTION

[0010] Fig. 1 is a schematic side view of a glazed-in arrangement according to a preferred embodiment of the invention. The glazed-in arrangement consists of four glass shutter parts, one not displaceable, pivotal part L_{FAST} and three displaceable and inwards/ outwards, respectively, turnable parts L_1 L_2 L_3. The displaceable parts L_1 to L_3 are both at the top and at the bottom provided with an attachment profile 3, permitting fixing of the sliding means 13, steering/turning means 10 and steering means 11. The lower sliding means 13 (which preferably carry all weight) are arranged slidably to run in a lower skid rail 2, which in its turn is adjustably mountable within an attachment profile 1, which is secured at the floor portion where the glazed-in arrangement shall be located.

[0011] In a corresponding manner, there is at the top an upper steering rail 5 which is provided to give support and steering to the upper sliding element 10 and the steering means 11, respectively. The upper steering rail 5 is in its turn adjustably arranged within an upper attachment profile 4, which is at the top secured parallelly to the lower attachment profile 1. Further, it is shown that at the top, adjacent to the end of the steering rail 5 where the stationary shutter L_{FAST} is arranged, there is arranged a link arrangement 12 according to the invention. Further, it is schematically shown that blocking means 6, 7, 8, 9 are arranged, which enable locking of the "stationary" shutter L_{FAST} in a firm position, but with release mechanisms opening of the shutter is also allowed.

[0012] In Fig. 2 it is in rough outline shown how an arrangement according to the invention is used to bring the window shutters from an spread-out use according to Fig. 1 to a folded condition. This is done in such a way that one begins to fold-in the stationary shutter part L_{FAST}, which in a manner known per se may be done by releasing a stop which locks the stationary shutter in its position parallel to the skid/steering rail 2, 5. Thereafter one displaces the first movable shutter part L_1 until it comes into an end position close to the stationary shutter L_{FAST}. In this position, its steering and turning element 10 will be able to take a position where it may interact with a pivot pin 123 which is arranged within the link arrangement 12. It should be made clear that the cross-section profile of the link arrangement 12 is compatible with the profile of the upper skid rail 5, so that a problem-free displacement of the sliding and turning element 10 may be achieved past the joint between the upper skid rail 5 and into the link arrangement 12. When the shutter L_1 is in the last mentioned position, its steering means 11 is also in a position to be turned out past an opening (not shown) in the side of the upper skid rail profile 5, as well as the rear lower sliding means 13 through an aperture in the lower skid rail 2. Then, the shutter L_1 is folded until it stands parallel to the stationary shutter, so that they extend perpendicularly in relation to the extension of the skid rails 2, 5. This procedure is repeated until all shutters L_1-L_3 have been placed tight to each other in a folded condition.

[0013] Figs. 4 and 5 show a cross-section of an attachment profile 1 and a lower skid rail profile 2, respectively, according to a preferred embodiment of the invention. The man skilled in the art realizes that one may give these profiles varying cross-section configurations within the

scope of the idea of the invention, i.e. many different types of profile appearances have the possibility to fulfil the basic functionality necessary to utilize the concept of the invention. This is, of course, true also for other profile elements shown.

[0014] The lower attachment profile 1 is a kind of a U-profile with a centre portion 16 which is intended to be placed on and fixed (e.g. by screws) to the floor where the glazed-in arrangement shall be arranged. Legs 17 extend vertically upwards in order to interact with the lower portion 20 of the lower skid rail profile 2. A possible height adjustment and levelling, which may be needed, is achieved by position adjusting the skid rail profile 2 in relation to the attachment profile 1.

[0015] At the upper part of the lower skid rail profile there is a longitudinal space 23 intended for the sliding/turning means 13 provided at the bottom at each displaceable shutter L_1-L_3. The sliding means 13 (which may be wheels or mere sliding means) are provided with downwards directed surfaces 130 intended in a slidable manner (or rollable) to interact with support/sliding surfaces 22 within the upper space 23 of the profile, which surfaces 22/130 interact such that a centration of the shutter is obtained by the gravity in a manner known per se. Through a slot 21 arranged at the top there is space for a neck-shaped portion (connecting the sliding means 13 with the profile 3 at the shutter L_1-L_3) to move freely along the lower sliding profile 2. Thanks to the space 23 being wider than the slot 21, a vertical fixation of the sliding means 13 inside the centre profile 2 is possible.

[0016] In Fig. 6 a attachment profile 3 is shown, which is intended to be fastened to the glass G both at the upper edge and the lower edge of each displaceable shutter L_1-L_3. The profile 3 is clamped to the upper edge and the lower edge, respectively, in a manner known per se by being pressed in between U-shaped legs 30. In the upper portion of the attachment profile 3 (the opposite fact is valid for the profile 3 at the bottom) there is in cross-section an essentially rectangular space 32 for the fixing means 100 of the sliding/turning and steering elements 10, 11, respectively, (also the fixing means (not shown) at the lower sliding means 13 utilizes the same principle). Through the longitudinal slot 33 a neck-shaped means 101 of the turning/steering element may protrude to admit adjustable positioning of said means 10, 11, 13 to the attachment profile 3.

[0017] In Figs. 7 to 10 different views of an upper steering and turnings means 10 according to a preferred embodiment of the invention are shown. As is seen, this means consists of a lower elongated attachment body 100, which has a rectangular cross-section adapted to the space 32 inside the attachment profile 3. Perpendicularly in relation to the attachment means 100 there is a neck-shaped means 101 protruding a considerable distance as to give enough space so that the sliding and turning means 10 at its other end has a cylindrical steering and turning, respectively body 102. The steering and turning body 102 consists of a circular base plate which is coaxially fixed to the end of the neck-shaped means 101 which is the steering part interacting with the slot 53 inside the upper skid rail 5. The neck 101 is long enough to admit that the steering/turning body 102 is positioned with a free vertical play (both at the top and at the bottom) within the space 51 to minimize the friction influence. In the lower horizontal wall portion 52 there are devices to arrange, in a manner known per se, rattle eliminating brush means. Upwards from the circular base part 103 an annular portion 108 extends with a height approximately corresponding to the height of the neck-shaped portion. A diametrically arranged groove 104 breaks through the annular portion, arranged parallelly to the extension of the attachment body 100. Inside the annular inner space 106 there are two opposite circular cylindrical surfaces 105, each of which also extending less than 180° but preferably at least 150°. These surfaces 105 form support surfaces at the folding of the respective shutter L_1-L_3, as will be explained more in detail below. As may be seen from the drawings, the width B of the groove 104 (which may also be defined as consisting of two grooves placed at a distance and aligned) preferably is approximately as large as the radial thickness of the ring segments or rather smaller than this one. The bending radius $^{d}/_{2}$ preferably corresponds to about 0.5-0.9 of the outer diameter D of the cylindrical body 102.

[0018] Figs. 11 and 12 show two side view of a steering means 11 intended to be used according to a preferred embodiment of the invention. The steering means is provided with an attachment body 110, which preferably is constructed in exactly the same manner as the attachment body 100 which is used for the sliding and turning means 10.

[0019] In any case, they have the same shape in cross-section as to be fixed in a similar manner inside the space 32 of the attachment profile 3. In a straight angle in relation to the attachment body 110, a steering means 111 extends a considerable distance, the length of which should suitably exceed at least the length of the neck-shaped means 101, so that it safely may run into the longitudinal slot 53 in the upper sliding profile 5, and preferably also into its inner space 51.

[0020] Figs. 13 and 14 show cross-section profiles of the preferred embodiments of the upper sliding profile 5 and the upper attachment profile 4, respectively. The upper attachment profile 4 has a U-shaped cross-section with a web 40 intended to be secured parallelly to the lower attachment rail 1 and the U-shaped legs 41 extending perpendicularly, on the inner side of which there are flutes 42 for easy adjustment of height/position of the sliding profile 5. The sliding profile 5 is thus fixed with its upper portion 50 inside the attachment profile 4, principally in a manner known per se. The lower portion of the sliding profile 5 has an inner longitudinal space 51 intended for the steering/turning body 102 of the sliding and turning element 10. The neck-shaped part 101 of the sliding and turning element 10 runs through a longitudinal slot 53 in the sliding profile 5 and its substantially cylin-

drical body 102 is then inside in that inner space 51 without abutting against any surface limiting the inner space 51 inside the sliding profile 5.

[0021] The steering body 111 of the steering means 11 protrudes up through the longitudinal slot 53 and is freely displaceable along the slot 53.

[0022] Figs. 15-24 show different views and cross-sections, respectively, of a link arrangement 12 according to the invention. Fig. 15 is a perspective view, from above, which shows that the link arrangement 12 comprises a substantially U-shaped profile element with a comparatively limited length (normally about 200 to 500 mm), the outer legs 120 of which are connected to a web 121 extending at a certain level above the bottom of the profile so that upper longitudinal edges 122 are formed which protrude a distance above the web 121. Between these edges 122 nut attachment means 124 are arranged. These nut attachment means 124 enable adjustable fixing of the link arrangement 12 inside the upper attachment rail 4. The number of such attachment means 124 may vary depending on strength requirements. In line with these attachment means 124 there are an outer aperture 126 in the web 121 and an intermediate aperture 125, respectively. The outer aperture is intended for a link axis to the stationary shutter L_{FAST}, while the intermediate aperture 125 enables adjustment of the attachment profile 4.

[0023] Fig. 16 shows a perspective view of the profile, seen oblique from below. Here it is seen that pivot pins 123 are arranged between the outer legs 120 in a centred manner along a line, which pins have the shape of flat elements. Each pivot pin 123 is intended for the turning of an own displaceable shutter L_1- L_3. Thus, the link arrangement shown is intended for one stationary shutter and seven displaceable and foldable, respectively, shutters. Between each pivot pin there is a gap m which is smaller than the longitudinal extension 1 of the pivot pin 123. The width b of the pivot pin is substantially smaller than the length 1 and corresponds with a minus tolerance (or preferably still somewhat smaller) to the width B of the groove 104 in the steering and turning means 10. In approximately the same manner, the length 1 of the pivot pin 123 corresponds to the inner diameter d between the cylindrical segment surfaces 105 inside the sliding and turning means 10.

[0024] As may be seen from Fig. 20 and Figs. 23 and 24, the end surfaces of the pivot pins 123 are arranged with a radius, which radius $d/_2$ is adapted approximately to correspond to the radius of the cylindrical segment surfaces 105. Further, it may be seen from Figs. 21, 23 and 24 that the height h of the pivot pins 123 is almost as large as the length 1 but preferably in the region of 0.5-0.9 1. In a corresponding manner the height H of the groove 104 in the steering and turning means 10 is somewhat larger than the height h of the pivot pin in order to give space to the steering and turning body 102 so it may easily be able to slide in below a pivot pin 123. The size of the cross-section x of the inner space 128 corresponds to the outer diameter D, so that a good guiding of the steering/turning body 102 is obtained inside the link arrangement 12. The outer dimensions, height/width, of the unit 12 are preferably such that the unit 12 may be inserted into the upper skid rail 5, inside the space 51 in which the steering and turning bodies 102 are placed. The unit is thereby entirely supported by the surrounding walls in the skid rail 5 and may easily be fixed inside the space 51 and in principle "automatically" obtain the correct position.

[0025] The function of the link arrangement 12 is such that it is mounted inside the upper sliding profile 5 to enable displacement of a steering and turning body 102 from the steering rail 5 directly into the link arrangement 12. As the shutter L_1-L_3, which is displaced, is parallel to the rails 5, 2, the groove 104 in the sliding and turning body 102 will be aligned with the extension of the pivot pins 123. This implies that the first shutter L_1, which is displaced into the link arrangement, will slide past one after the other of the pivot pins 123, thanks to good guiding between the inner wall 129 and the cylindrical surface 107, respectively, until it comes into contact with the wall portion 128 of the attachment means 127 for the stationary shutter. In this position, the circular inner space 106 inside the turning body 102 is in a centred position in relation to the outermost pivot pin 123 transversal by being supported by the inner walls 129. When then a turning is started (by laterally releasing the steering means 11 from the upper skid rail 5) the end portions 123A of the pivot pin 123 will come into contact with the cylindrical segment surfaces 105 and have hence in principle immediately achieved steering of the turning motion of the shutter. Thanks to the groove 104 being only marginally wider B than the width b of the pivot pin 123 and the length 1 of the pivot pin essentially corresponding to the diameter d, a very small distortion will be needed to establish a steering contact.

[0026] An additional advantage with a constructional concept according to the invention is that the design makes it possible to be able to displace the window shutters past corners, i.e. past skid rails being arranged at an angle in relation to each other, e.g. 90°. This will be possible thanks to the outer configuration of the steering and turning body 102 being arranged rotation symmetrically with regard to the centre of the steering and turning body 102, in combination with the skid rail 5 being symmetric with regard to its longitudinal centre line. Known solutions with a possibility to fold window shutters together do not usually offer this possibility, as the grooves and/or the turning body often is not symmetric, which implies that the sliding body cannot be inserted into an angled skid rail, at least not without either complex and/or expensive additional steps.

[0027] The invention is not limited to the above description but may be varied within the scope of the appending claims. The man skilled in the art realizes among other things that it is not necessary that the link arrangement forms an own unit 12 but may consist of several

separate module units which are built together to the desired length/number and also that a unit 12 (and module units, respectively) do not have to be arranged inside the skid rail 5 but instead be arranged separately in connection to the skid rail, in the fixing rail 4. In addition, it is realized that it is not necessary that a pivot pin 123 is entirely continuous but may be divided, as it is the outer edge portions 123A which are the steering surfaces enabling the good functionality. Thus, one may in an extreme case conceive two pin-shaped means arranged at a distance, which form the two steering surfaces 123A. Further, it is realized that in a corresponding manner the cylindrical segments 105 may be shortened substantially in those cases when one only wants to fold in one and the same direction (max. 90°), wherein it is enough that the extension of the segments on each side of the turning centre extends about 90°. On the other hand, there are many advantages by constructing the segments in accordance with what is shown in the figures, partly as it enables turning in both directions, partly as such a design contributes to an increased strength. In addition, it is realized that there are possibilities to use the same principle also at the lower sliding means 13 so that also this one is fixed in its angled-out position. On the other hand, this is not always desirable /necessary, as the moment acting on a shutter at the angling-out aims at pressing the lower sliding body 13 in a direction towards the stationary shutter. If a fixation at the angling-in is desired also at the bottom, it may be an advantage to design the lower pivot pin as a nail which implies that a through groove in the lower sliding body 13 is enough to offer the functionality. Further, the forces influencing the lower pivot pin will be considerably smaller which may also be regarded as motivation for a less strong pivot body, e.g. in the form of a nail. Moreover, the man skilled in the art, of course, realizes that there is scope for a variation in the choice of different materials and configurations of the included elements for a construction which is contained within the basic principles of the invention in order to fulfil the principal solution of the invention.

Claims

1. An arrangement at displaceable and inwards/outwards turnable shutters, preferably glass shutters, comprising at least one displaceable shutter (L_1), with steering/turning means (10, 11) arranged at its upper side and sliding/turning means (13) arranged at its lower side, an upper steering/skid rail (5) with a downwards open, longitudinal slot (53) and an inner longitudinal space (51) adjacent to the slot 53), a lower steering/skid rail (2) with an upwards open, longitudinal slot (21) and adjacent to the slot (21) an inner longitudinal space (23) with sliding surfaces (22) at the bottom, wherein the upper steering/turning means (10, 11) are arranged to be displaced along the upper steering/skid rail (5), and the lower sliding/turning means (13) are arranged to be displaced along the lower steering and skid rail (2), and that inside said upper skid rail (5) or in direct connection thereto there is a link arrangement (12) with steering wall portions (129) which are arranged to admit inward/outward turning of said displaceable shutter (L_1), in at least one position, **characterized in that** said link arrangement (12) comprises at least one pivot pin (123) which is arranged to protrude at a distance from said steering wall portions (129), preferably positioned on or adjacent to the centre line of the longitudinal link space (128) which is defined by said steering wall portions (129) and that said steering/turning means (10) are provided with a steering/turning body (102 with a through groove (104) adapted to accommodate said pivot pin (123).

2. An arrangement according to claim 1, **characterized in that** said pivot pin (123) has a longitudinal extension (1) which essentially exceeds the width (b), and that the steering/turning body (102) has at least to annular sections, the opposite support surfaces (105) of which extend along a diameter (d) which substantially corresponds to the longitudinal extension (1) of said pivot pin (123).

3. An arrangement according to claim 2, **characterized in that** the end surfaces (123A) of the pivot pin (123) which are arranged to interact with said support surfaces (105) have a bending radius which essentially corresponds to the radius of said support surfaces (105).

4. An arrangement according to claims 1 to 3, **characterized in that** said link arrangement (12) comprises a plurality of pivot pins (123) positioned with the same pitch (m) along a centre line of said link space (128).

5. An arrangement according to claim 4, **characterized in that** said link arrangement is an own body (12) arranged to be fixed in connection to and as an elongation of said upper skid rail (5), and wherein preferably the horizontal cross-section dimension of said link space (128) essentially corresponds to the outer diameter (D) of said steering/turning body (102), while the corresponding cross-section dimension of the corresponding inner space (51) is considerably larger than said diameter (D).

6. A steering/turning means for an arrangement according to any of claims 1 to 5, wherein said steering/turning means (10) comprises an attachment body (100), a steering/turning body (102) and a neck means (101) connecting the steering/ turning body (102) with the attachment means (100), **characterized in that** said steering/turning body (102) has a through groove (104) which is open upwards.

7. A steering/turning means according to claim 6, **characterized in that** said steering/turning body (102) has a rotation-symmetrical, outer periphery and a thereto coaxially arranged rotation-symmetrical cavity (106), wherein said grooves (104) intersects said cavity (106) and forms two separate, annular segments (108) with opposite support surface (105).

8. A steering/turning means according to claim 7, **characterized in that** the height (H) of said steering groove (104) is 0.1-1 of the total height of the steering/turning body (102), preferably 0.6-0.9.

9. A steering/turning means according to claim 7 or 8, **characterized in that** said groove (104) has a width (B) which is essentially smaller than the outer diameter (D) of the sliding body (102), preferably $0.1 < (D) < 0.05$.

10. A link arrangement for an arrangement according to any of claims 1 to 5, which link arrangement (12) comprises a base body (120), in which a plurality of pivot pins (123) are placed along a line.

11. A link arrangement according to claim 10, **characterized in that** said pivot pins (123) has a longitudinal extension (1) which is larger than its transversal extension (b).

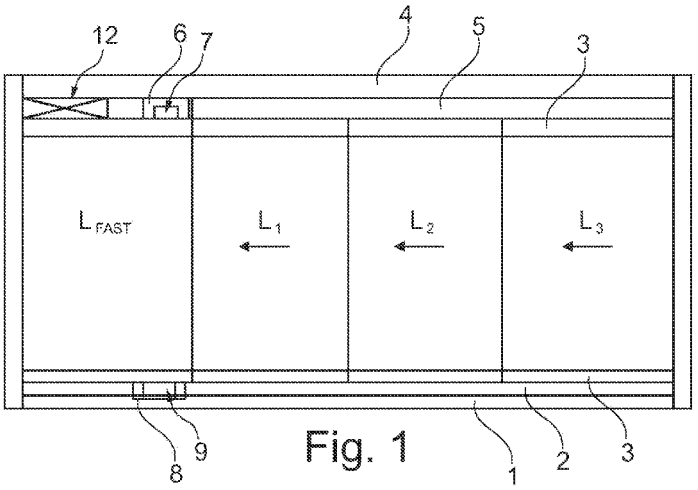


Fig. 1

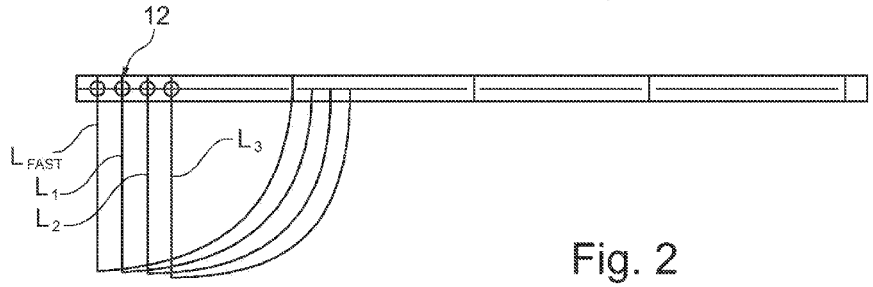


Fig. 2

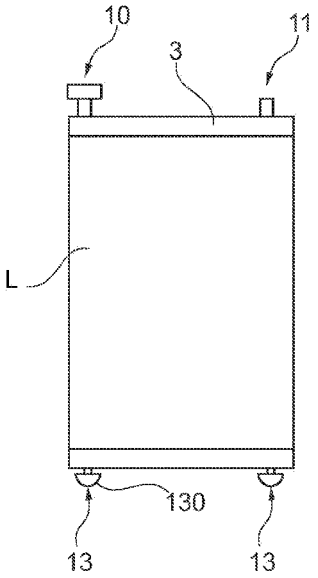


Fig. 3

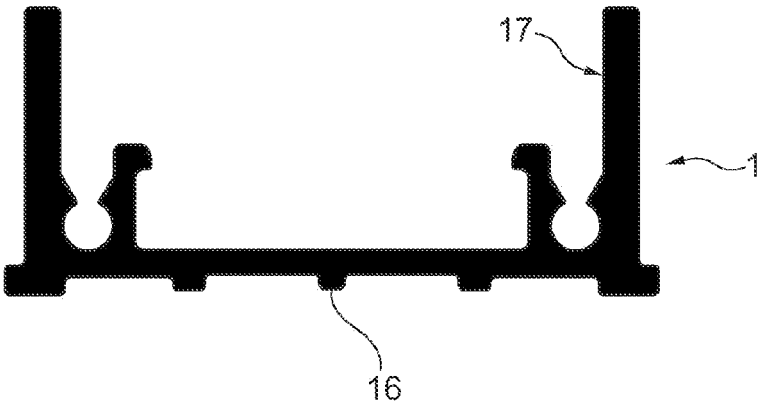


Fig. 4

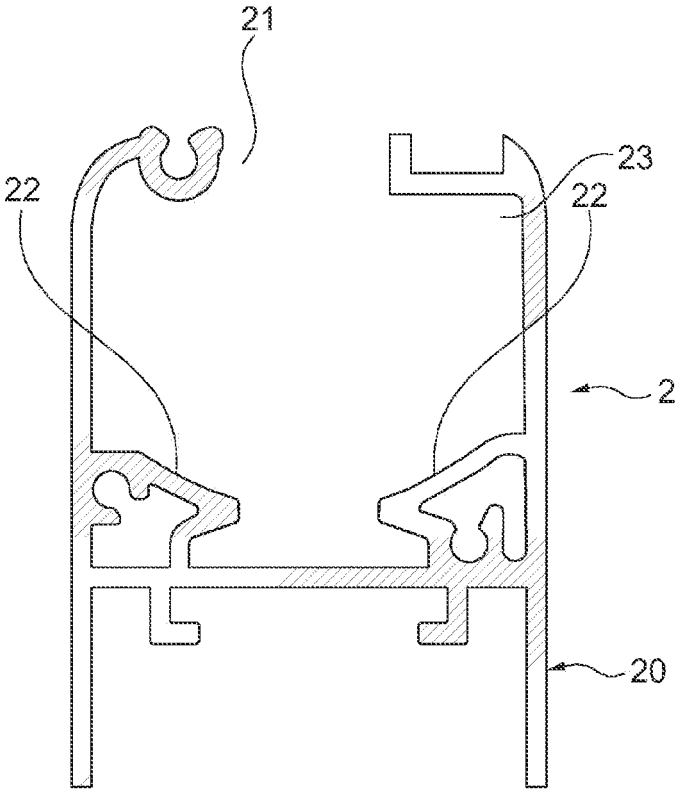


Fig. 5

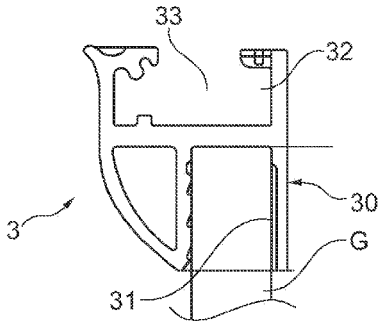


Fig. 6

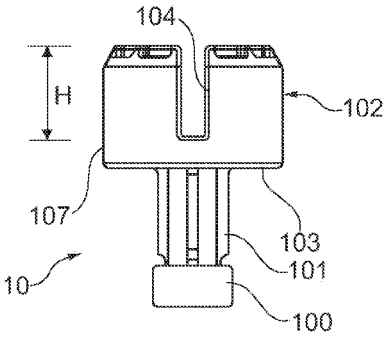


Fig. 7

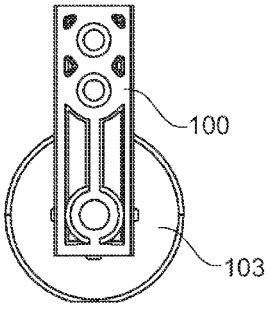
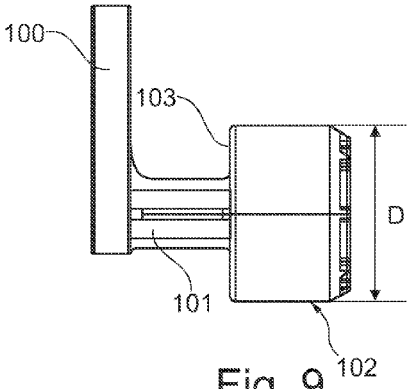


Fig. 8



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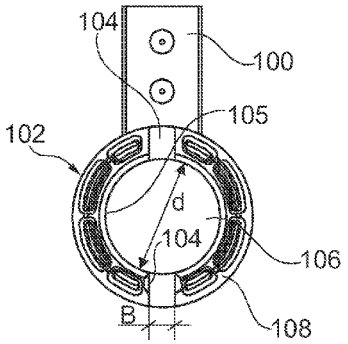

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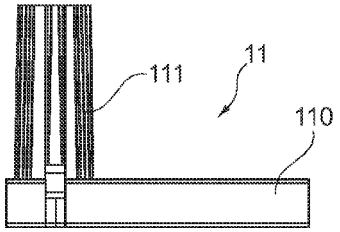

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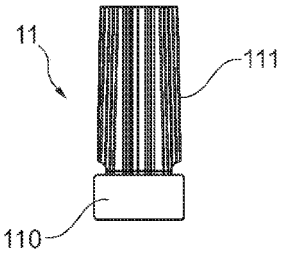

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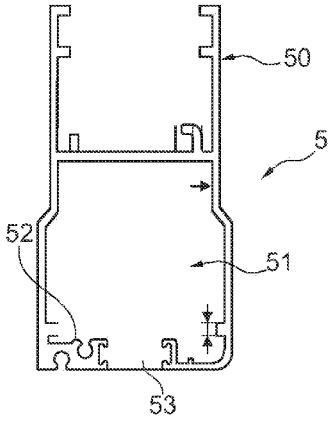

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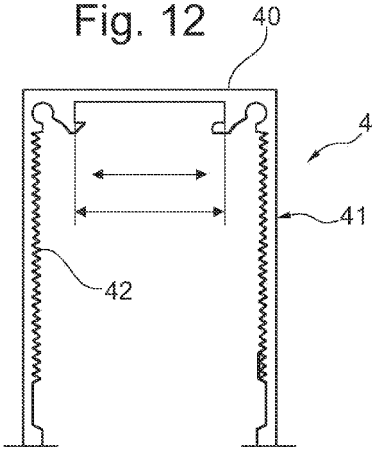

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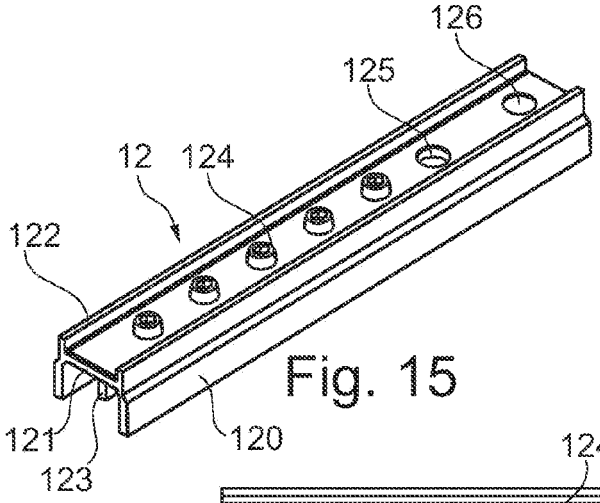

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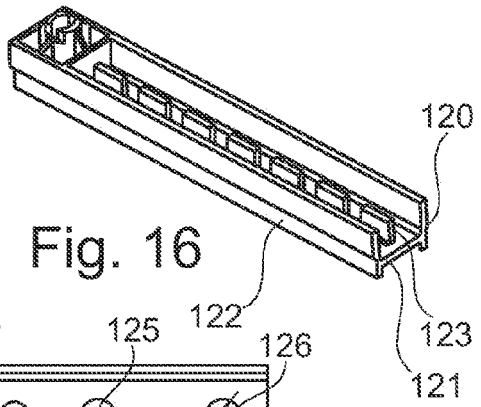

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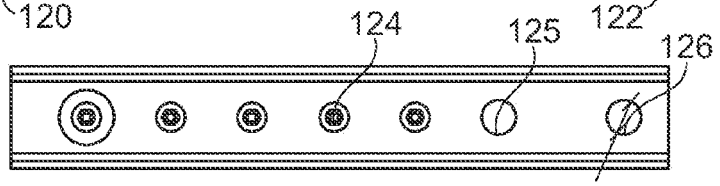

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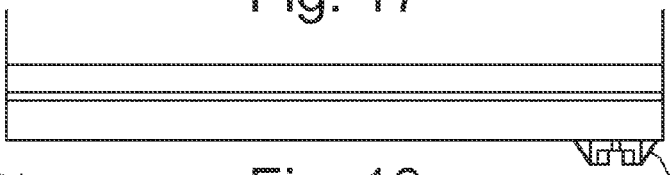

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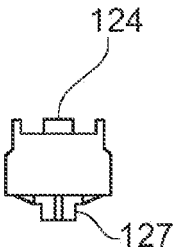

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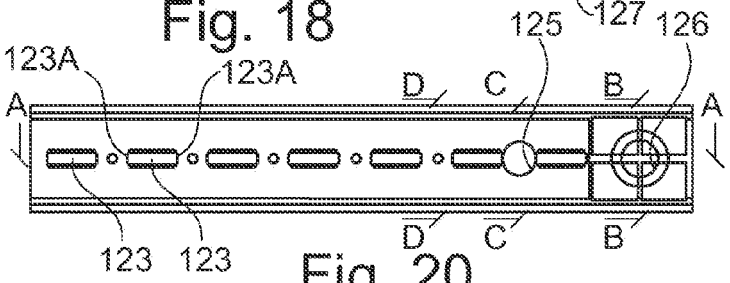

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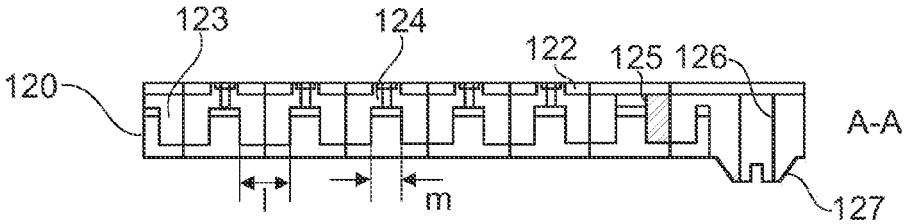

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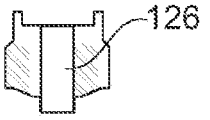

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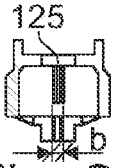

Fig. 23

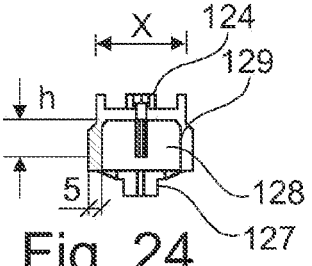

Fig. 24

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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