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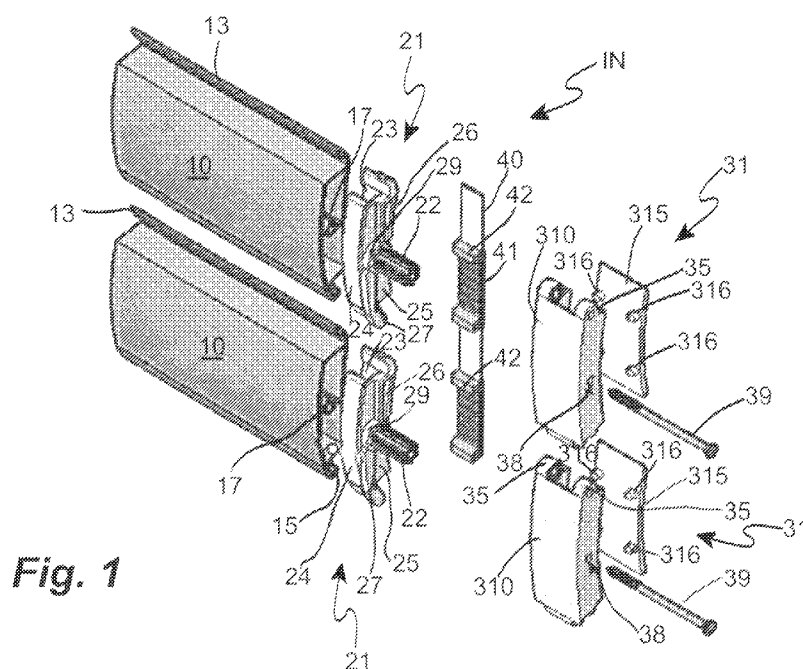


Fig. 1

(57) Abstract: Roller shutter comprising a curtain configured to assume a fully deployed and screening configuration in which it occupies an aperture of the wall on which the roller shutter is applied, the curtain comprising a plurality of tiltable intermediate slats (10; 100) each having two side ends each provided with a respective side pivot (22; 220) provided with teeth that inserts into a respective side support (30; 31; 321), whereby each tiltable intermediate slat (10; 100) is rotatably coupled to a pair of respective side supports (30; 31; 321), the side supports (30; 31; 321) being coupled to each other through hinge coupling means (35; 36; 360) so as to form two side chains, each side chain housing a drive belt (40; 41; 400) configured to slide within the side supports (30; 31; 321) and to interact with the side pivots (22; 220), the curtain further comprising telescopic means (90; 95; 65) configured to cause the two drive belts (40; 41; 400) to assume a first limit position within the respective side chains, wherein the tiltable intermediate slats (10; 100) assume a

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basic orientation where they are aligned to the respective side supports (30; 31; 321), and a second limit position within the respective side chains, wherein the tiltable intermediate slats (10; 100) assume a maximum angle orientation with respect to the respective side supports (30; 31; 321), whereby, when the curtain assumes the fully deployed and screening configuration, a force applied on at least one of the tiltable intermediate slats (10; 100) causes a rotation of the respective side pivots (22; 220) that is transmitted through the two drive belts (40, 41; 400) to the side pivots (22; 220) of all the other tiltable intermediate slats (10; 100).

ROLLER SHUTTER WITH TILTABLE SLATS

* * *

The present invention concerns a roller shutter with tiltable slats, applicable to an aperture of a wall, such as a door, a window or an entrance, e.g. of an apartment, shop, garage or store, comprising a plurality of slats which form a curtain that may assume a configuration fully wound on a drum and a fully deployed configuration in which the curtain occupies the whole space of the aperture of the wall on which the roller shutter is applied, the roller shutter allowing in an efficient, reliable, simple and inexpensive way to tilt the slats in an adjustable manner when the roller shutter is in the fully deployed configuration. Also, the roller shutter with tiltable slats according to the invention is advantageously configured to slide along the same standard sliding side guides (i.e. conventional side guides configured to allow standard roller shutters with non-tiltable slats to slide), possibly already installed in the aperture of the wall, and to be moved by a standard drum (i.e. a conventional drum configured to move standard roller shutters with non-tiltable slats), whereby the roller shutter permits to be installed in a simple and, consequently, fast and inexpensive way, without requiring masonry work in correspondence of the aperture of the wall on which it is applied.

It is known that apertures present in the walls of buildings, such as doors and windows of apartments and shops and entrances of garages and stores, are provided with roller shutters each comprising a plurality of slats, connected to one another, which form a curtain that may steadily assume a configuration fully wound on an upper drum, generally arranged in a compartment of the wall placed above the top of the aperture, and a fully deployed configuration in which the curtain occupies the whole space of the aperture of the wall on which the roller shutter is applied. In particular, the upper terminal slat is coupled, for instance through a plurality of ropes or belts, to the upper drum, whereby the rotations of the latter cause a movement of the curtain; when the curtain is in the fully deployed configuration, the lower terminal slat rests on the floor (e.g. on the threshold of the aperture, such as the sill of a window or door) and supports the weight of the whole curtain. In the fully wound configuration the aperture is free, while in the fully deployed configuration the aperture is completely closed by the roller shutter; obviously, the roller shutter (and the curtain thereof) may also steadily assume any intermediate configuration between the fully wound configuration and the fully deployed configuration.

As stated, the movement of the roller shutter from the fully wound configuration to the

fully deployed configuration and vice versa is caused by the rotation of the upper drum that, by rotating in one direction, allows the roller shutter to fall under gravity, and, by rotating in the opposite direction, drags the roller shutter upwards by causing it to wind up on the same upper drum; in particular, the drum may have the outer surface, on which the roller shutter winds up, having a polygonal section, e.g. an octagonal one. During the movement, the ends of the slats of the roller shutter slides within two side guides placed on (or parallel to) two vertical flanks of the wall delimiting the aperture, whereby the two side guides are arranged along the sliding direction of the slats during the movement of the roller shutter from the fully wound configuration to the fully deployed configuration and vice versa. The rotation of the upper drum is controlled by a user by manually operating mechanical devices, such as a belt secured to an upper pulley (integrally coupled to the upper drum) and to a lower winder with elastic return spring, or a hand crank coupled to one or more motion transmission elements such as joints, rods, and couplings which transmit the hand crank motion to an upper hoist (coupled to the upper drum), or by activating an electric motor that puts a shaft integrally coupled to the upper drum into rotation.

In the last years roller shutters have been proposed which have at least part of the slats that, at least in the fully deployed configuration, are tiltable, i.e. are rotatable, possibly in an adjustable manner, around their own longitudinal axes (orthogonal to the longitudinal axis of the side guides and, hence, to the sliding direction of the slats), so as to let air and light pass to an extent proportional to the orientation (or tilt) angle of the slats, similarly to what happens with the shutters applied to the windows.

Some examples of such roller shutters with tiltable slats are disclosed in documents EP 1149977 A1, EP 1286016 A2, EP 1837480 A2, WO 2009/143842 A1, WO2010/082227 A2, WO 2012/080386 A1 and EP 2722475 A1; similar known examples of roller shutters with tiltable slats are marketed with the trade names "Orienta" and "RollTek" by the Italian company Non Solo Porte e Finestre s.r.l., and the related brochures are publicly available on the Internet at the web pages at the addresses:

<http://sunproject.nonsoloportee finestre.it/wp-content/uploads/2014/09/BrochureOrienta.pdf> and
<http://sunproject.nonsoloportee finestre.it/wp-content/uploads/2015/03/BrochureRollTek.pdf>.

However, the prior art roller shutters with tiltable slats suffers from some drawbacks.

First of all, they are made through rather complex mechanical structures, sometimes with

significantly greater weight than the roller shutters with non-tiltable slats, which also require dedicated sliding guides, having specific outlines, and usually also dedicated upper drums.

This entails that their operation is subject to malfunctions and, sometimes, requires a motorised actuation so as to accurately control the movements of the roller shutter in order to
5 reduce damages caused by manual actuations.

Moreover, their manufacture entails long times and high costs, their installation requires masonry works, for mounting the dedicated sliding side guides and possibly the dedicated upper drums, and finally they require a frequent maintenance.

Therefore, it is an object of the present invention to allow in an efficient, reliable, simple
10 and inexpensive way to tilt the slats of a roller shutter in an adjustable manner when the latter is in the fully deployed configuration, permitting the use of standard sliding side guides, possibly already installed in the aperture of the wall on which the roller shutter is applied, and of a standard drum.

It is specific subject matter of the present invention a roller shutter with tiltable slats as
15 defined in independent claim 1.

Further embodiments of the roller shutter with tiltable slats according to the invention are defined in the dependent claims.

It is also specific subject matter of the present invention a kit of components for mounting the roller shutter with tiltable slats according to the invention.

20 The advantaged offered by the roller shutter with tiltable slats according to the invention with respect to the prior art solutions are numerous and significant.

In fact, the roller shutter according to the invention has a rather simple and light structure and may slide within standard side guides (configured to allow standard roller shutters with non-tiltable slats to slide), possibly already installed in the aperture of the wall on which the roller
25 shutter is applied, and it may be moved by a standard drum.

This entails that the roller shutter according to the invention may be manufactured in a simple way, and consequently in shorter times and with lower costs than the prior art solutions.

Also, since it is not necessary to make any masonry work to mount dedicated sliding side guides and/or dedicated upper drums, even the installation times and costs are lower than those
30 of the prior art roller shutters with tiltable slats.

Finally, the structure simplicity drastically reduces maintenance costs of the roller shutter according to the invention with respect to the prior art solutions.

The present invention will be now described, by way of illustration and not by way of limitation, according to its preferred embodiments, by particularly referring to Figures of the annexed drawings, in which:

Figure 1 shows a first exploded perspective view of a first portion of a first embodiment
5 of the roller shutter according to the invention;

Figure 2 shows a second exploded perspective view of the first portion of roller shutter
of Figure 1;

Figure 3 shows a sectional perspective view of a second portion of the roller shutter of
Figure 1;

Figure 4 shows a third exploded perspective view of the first portion of roller shutter of
Figure 1;

Figure 5 shows a right side view of a third portion of the roller shutter of Figure 1;

Figure 6 shows a first perspective view of a fourth portion of the roller shutter of Figure
1 in a first configuration (Fig. 6a), two perspective views of some internal components of the
fourth portion in the first configuration (Fig. 6b) and in a second configuration (Fig. 6c), and a
perspective view of some side components of the fourth portion (Fig. 6d);

Figure 7 shows two right side views of the fourth portion of the roller shutter of Figure
6a in the first (Fig. 7a) and second configuration (Fig. 7b);

Figure 8 shows a second perspective view of the fourth portion of roller shutter of Figure
6a in the first configuration;

Figure 9 shows a perspective view of the roller shutter of Figure 1 having five tiltable
intermediate slats in the first (Fig. 9a) and second configuration (Fig. 9b);

Figure 10 shows a perspective view of a portion of the roller shutter of Figure 1 having
three tiltable intermediate slats in the first configuration (Fig. 10a) and a partially exploded
perspective view of the roller shutter of Fig. 10a in the second configuration;

Figure 11 shows a first perspective view of a component (Fig. 11a) and of a portion (Fig.
11b) of a second embodiment of the roller shutter according to the invention;

Figure 12 shows a second perspective view of the component (Fig. 12a) and of the portion
(Fig. 12b) of the roller shutter of Figure 11; and

Figure 13 shows a exploded perspective view of some components of the roller shutter
of Figure 11.

In the Figures identical reference numerals will be used for alike elements.

It must be understood that the (relative) definitions of front, rear, top, bottom, right side, left side, proximal and distal conventionally refer to an orientation of the point of view that is not essential and may be modified, still remaining within the scope of protection of the present invention as defined by the attached claims.

5 Furthermore, it must be understood that the (relative) definitions of width, length and height conventionally refer to an orientation of the three linear dimensions orthogonal to each other of the components of the roller shutter with tiltable slats according to the invention that is not essential and may be modified, still remaining within the scope of protection of the present invention as defined by the attached claims.

10 With reference to Figures 1-4, it may be observed that a first embodiment of the roller shutter with tiltable slats according to the invention comprises a plurality of tiltable intermediate slats 10, of which only an end portion is shown in Figures 1-4: assuming that the point of view of the roller shutter is the one indicated in the Figures by the arrow IN, i.e. it is from the internal part of the aperture to which the same roller shutter is applied (i.e. from inside the building to
15 which the aperture belongs), only a left end portion of each tiltable intermediate slat 10 is shown in Figures 1-4. The two right and left ends are provided with a respective right cover 20 (shown in Figure 9b) and with a respective left cover 21, specularly symmetrical to each other, both provided with a side perforated toothed pivot 22, parallel to the longitudinal axis of the tiltable intermediate slats 10 (where the longitudinal axis of the tiltable intermediate slats 10 is
20 orthogonal to the upward and downward sliding direction of the same slats), that protrudes in opposite direction to the end of the tiltable intermediate slat 10 to which the right or left cover 20 or 21 is coupled (whereby the perforated toothed pivot 22 is distal with respect to the tiltable intermediate slat 10); in other words, each left cover 21 has a left toothed pivot 22, and each right cover 20 has a right toothed pivot (not shown in the Figures).

25 The right cover 20 and the left cover 21 are coupled, optionally in a removable way, to the right and left ends, respectively, of a respective tiltable intermediate slat 10, advantageously through a snap-fit connection. In the first embodiment of the roller shutter according to the invention, when a right or left cover 20 or 21 is coupled to a respective right or left end of a tiltable intermediate slat 10, its perforated toothed pivot 22 is advantageously arranged in
30 correspondence of a mass centroid, coinciding with the geometrical centroid, of the cross-section (according to a plane orthogonal to the longitudinal axis of the slats) of the tiltable intermediate slat 10; in other embodiments of the roller shutter according to the invention, the

perforated toothed pivot 22 may be arranged in correspondence of a mass centroid or of a geometrical centroid of the cross-section of the tiltable intermediate slat 10 or the perforated toothed pivot 22 may be arranged at different positions from such centroids. In particular, the tiltable intermediate slats 10 and the covers 20 and 21 have advantageously similar cross-sections. As better shown in Figure 4, each tiltable intermediate slat 10 comprises a profile having a central body 11, that is advantageously hollow, from which an upper projecting inner wing 12, with curvilinear outline such that it directs the end 13 outwards, and a lower projecting outer wing 14, with curvilinear outline such that it directs the end 15 inwards, protrude. Also, the central body 11 of the tiltable intermediate slat 10 is provided, advantageously for the entire length of the tiltable intermediate slat 10, with a perforated rib 17 parallel to the longitudinal axis of the same slat and that runs the entire length of the tiltable intermediate slat 10, arranged in correspondence of the mass centroid, coinciding with the geometrical centroid, of the cross-section of the tiltable intermediate slat 10, so that the hole of the perforated rib 17 faces the hole of the perforated toothed pivot 22 of the left cover 21 (or of the right cover 20) when the latter is coupled to the respective left (or right) end of the tiltable intermediate slat 10. In other embodiments of the roller shutter according to the invention, the perforated rib 17 may be present only on the end portions of the tiltable intermediate slat 10.

By making reference to the left covers 21 shown in Figures 1-4 and by noting that the right covers 20 are specularly symmetrical to the left ones 21, each left cover 21 comprises a transverse shaped plate 25 from which an upper distal inner ledge 26 and a lower distal outer ledge 27 protrude (whereby the upper distal inner ledge 26 and the lower distal outer ledge 27 protrude in opposite direction to the tiltable intermediate slat 10). Such upper distal inner ledge 26 is shaped so as to correspond to the inner outline of the central body 11 and of the upper projecting inner wing 12 of the tiltable intermediate slat 10, while such lower distal outer ledge 27 is shaped so as to correspond to the outer outline of the central body 11 and of the lower projecting outer wing 14 of the tiltable intermediate slat 10. Moreover, a proximal inner ledge 23 and a proximal outer ledge 24 protrude from the transverse shaped plate 25 (whereby the proximal inner ledge 23 and the proximal outer ledge 24 protrude towards the tiltable intermediate slat 10), and have outlines corresponding to the inner outline and outer outline, respectively, of the central body 11 of the tiltable intermediate slat 10. A right cover 20 (or a left cover 21) is configured to couple through snap-fit elastic connection (more optionally in a removable way) to the right (or left) end of a respective tiltable intermediate slat 10 by means

of the proximal inner and outer ledges 23 and 24. In the first embodiment of the roller shutter according to the invention the proximal inner and outer ledges 23 and 24 of the right cover 20 (or left cover 21) externally couple to the central body 11 of the tiltable intermediate slat 10; however, it must be noted that other embodiments may have different coupling arrangements, wherein for instance the proximal inner and outer ledges 23 and 24 of the right cover 20 (or left one 21) internally couple to the central body 11 of the tiltable intermediate slat 10 (in this case, the proximal inner and outer ledges 23 and 24 are shaped so as not to interfere with the perforated rib 17).

The perforated toothed pivot 22 of the left cover 21 of each tiltable intermediate slat 10 inserts into a proximal through hole 32 of a respective left side support 31 (i.e. arranged on a wall that is "proximal" with respect to the tiltable intermediate slat 10 and to the left cover 21), which left side support 31 is further provided with a distal through hole 38 (i.e. arranged on a wall that is "distal" with respect to the tiltable intermediate slat 10 and to the left cover 21), arranged substantially coaxially with the proximal through hole 32. The distal through hole 38 is configured to receive a self-tapping screw 39 that is configured to insert (by passing through the proximal through hole 32) also into the hole of the perforated toothed pivot 22 of the left cover 21 and into the hole of the perforated rib 17, in which it is capable to form an internal thread (other embodiments of the roller shutter according to the invention could have the holes of the perforated toothed pivot 22 of the left cover 21 and of the perforated rib 17 which are already threaded, whereby the screw 39 could be also non self-tapping). The overall length of the perforated toothed pivot 22 is substantially equal to the distance between the proximal and distal through holes 32 and 38 of the left side support 31. In this regard, the base 29 of the perforated toothed pivot 22, that projects with respect to the height of the teeth of the latter, operates as element for stopping the left cover 21 in inserting the perforated toothed pivot 22 into the proximal through hole 32 of the left side support 31, whereby the perforated toothed pivot 22 of the left cover 21 cannot insert into such proximal through hole 32 beyond a limit position. When the perforated toothed pivot 22 of the left cover 21 is inserted into the proximal through hole 32 of the left side support 31 and secured by the screw 39, the left cover 21 and the respective tiltable intermediate slat 10 to which it is coupled are rotatably coupled to the left side support 31. In the first embodiment, the height of the left side support 31 is substantially equal to the height of the respective tiltable intermediate slat 10.

The left side support 31 is formed by two components: a main element 310, arranged

towards the outside of the roller shutter and provided with the proximal and distal through holes 32 and 38, and a lid 315 provided with pins 316 configured to insert into corresponding holes 311 of the main element 310 so that the lid 315 is coupled, optionally through snap-fit elastic connection (more optionally in a removable way), to the main element 310; in other
5 embodiments of the roller shutter according to the invention, the lid 315 may be coupled to the main element 310 through different mechanical coupling means, optionally removable one, such as screws and washers, rivets and washers, or nuts and bolts, possibly operating in combination with the pins 316 and/or the holes 311, or the right and left side supports may be made in one piece.

10 The left side support 31 is provided with an upper terminal aperture 33 and a lower terminal aperture 34 configured to allow a belt 40 to pass, which belt is provided with a plurality of toothed elements 41 (the number of toothed elements 41 is equal to the number of tiltable intermediate slats 10) coupled to the belt 40 at a regular distance from one another, the teeth of which are configured to interact with the teeth of the perforated toothed pivot 22 of the left
15 cover 21 that is inserted into the left side support 31. In this regard, the distance between the centres of successive toothed elements 41 is equal to the distance between the longitudinal axes of perforated toothed pivots 22 of left covers 21 coupled to adjacent tiltable intermediate slats 10. Each toothed element 41 is housed within a left side support 31 and, as it will be described in greater detail later, has length at least equal to the circumference arc that a tooth of a
20 perforated toothed pivot 22 describes during the rotation of the latter from a basic angle orientation, wherein the respective tiltable intermediate slat 10 is aligned to the respective right and left side supports 30 and 31 (whereby the rotation angle is equal to 0°, as shown in Figures 6a, 6b, 7a, 8, 9a and 10a) to a maximum angle orientation of the tiltable intermediate slats 10 (as shown in Figures 7b, 9b and 10b). Other embodiments of the roller shutter according to the
25 invention may comprise a toothed belt, instead of the (smooth) belt 40 provided with a plurality of toothed elements 41.

As shown in Figures 3 and 4, the left side support 31 is configured to make the belt 40 pass so that the latter is arranged at a position offset towards the inside (of the building to which the aperture belongs) with respect to the position of the perforated toothed pivot 22 and that
30 the teeth of the toothed elements 41 are directed outwards, i.e. towards the perforated toothed pivot 22, to interact with the latter. As it will be described later, the left side support 31 is configured to allow the belt 40 to slide upwards and downwards with respect to the left side

support. In particular, the belt 40 is flexible, whereby it is configured to follow the winding of the roller shutter on a drum 60, shown in Figures 9 and 10 (optionally even the toothed elements 41 are flexible). In other embodiments of the roller shutter according to the invention, the belt could be made as a chain formed by a plurality of components, each provided with a respective toothed element 41, hinged to each other and advantageously having length substantially equal to the height of the tiltable intermediate slats 10, and in this case individual components of the chain that forms the belt could be also not flexible.

As shown in Figures 6 and 8-10, each left side support 31 is configured to be coupled, optionally in a removable way, to two identical adjacent left side supports 31, positioned one above and one below the left side support 31 under consideration. Turning to make reference to Figures 1, 2 and 4, in the first embodiment of the roller shutter according to the invention, each left side support 31 is attached to two identical adjacent left side supports 31 through a pair of upper circular slots 35, arranged at the sides of the upper terminal aperture 33 and in outward direction with respect to the latter (by still considering that the point of view is from the inside of the building to which the aperture where the roller shutter is mounted belongs), and a lower perforated cylinder 36, arranged in outward direction with respect to the lower terminal aperture 34: the pair of upper circular slots 35 of a first left side support 31 are flanked to the lower perforated cylinder 36 of a second left side support, that is adjacent and above the first one, with the pair of upper circular slots 35 (of the first one) which are positioned on the bases of the lower perforated cylinder 36 (of the second one) keeping the upper terminal aperture 33 of the first one and the lower terminal aperture 34 of the second one free to allow the belt 40 to pass from the second left side support to the first one, while the lower perforated cylinder 36 of the first left side support 31 inserts into the pair of upper circular slots 35 of a third left side support, that is adjacent and below the first one, keeping the lower terminal aperture 34 of the first one and the upper terminal aperture 33 of the third one free to allow the belt 40 to pass from the first left side support to the third one. The adjacent left side supports 31 may be rotatably coupled to one another, namely with a hinge coupling, by inserting coupling components, optionally removable ones, such as screws and washers, rivets and washers, or nuts and bolts, into the flanked slots and perforated cylinders. In this way, as shown in Figures 6 and 8-10, the pairs of upper circular slots 35 and the lower perforated cylinders 36 operate as hinges allowing the reciprocal rotation of the adjacent left side supports 31 which, in this way, form a chain.

Similarly to the right and left covers 20 and 21, also the right side support 30 (shown in Figure 9) and the left side support 31 are specularly symmetrical to each other, whereby the mode of coupling a right side support 30 to a respective right cover 20 are completely identical. In particular, even the right side support 30 is provided with an upper terminal aperture and a lower terminal aperture configured to allow a belt to pass, which belt is provided with a plurality of toothed elements (or it is a toothed belt) the teeth of which are configured to interact with the teeth of the perforated toothed pivot of the right cover 20 that is inserted into the right side support 30; also the right side support 30 is configured to allow the belt to slide upwards and downwards with respect to the right side support. Furthermore, even the modes of coupling adjacent right side supports 30 to each other are similar to those of the adjacent left side supports 31.

As shown in Figures 9 and 10, the left side supports 31 and right side supports 30 are configured to slide within standard side guides 50 mounted on two side flanks of the wall which delimit the aperture to which the roller shutter according to the invention is applied.

Figures 9 and 10 show the first embodiment of the roller shutter according to the invention comprising a plurality of tiltable intermediate slats 10 (in Figure 9 these are five, while in Figure 10 they are three), and further including an upper terminal slat 70, that is non-tiltable and is adjacent to a top tiltable intermediate slat 10' since the former is arranged just above the latter. The upper terminal slat 70 is coupled to two right and left upper terminal side supports 72 and 74 (also configured to slide within standard side guides 50), advantageously similar to the right and left side supports 30 and 31 to which the tiltable intermediate slats 10 are rotatably coupled, and which are configured to couple to the right and left side supports 30 and 31 of the top tiltable intermediate slat 10'. In this regard, the upper terminal slat 70 is coupled at a fixed angle to the two right and left upper terminal side supports 72 and 74, and it is thus devoid of the right and left covers 20 and 21; to this end, in the first embodiment of the roller shutter according to the invention two self-tapping screws 39 are configured to be screwed, respectively, into the two right and left upper terminal side supports 72 and 74 and into the ends of the hole of a perforated rib 17 with which also the upper terminal slat 70 is provided. In particular, in the first embodiment of the roller shutter according to the invention, the two right and left upper terminal side supports 72 and 74 are provided with a lower terminal aperture similar (or identical) to the lower terminal aperture 34 of the right and left side supports 30 and 31 to allow the belt 40 to pass through itself; the two right and left upper terminal side supports 72 and 74

are also provided with a lower perforated cylinder (similar or identical to the lower perforated cylinder 36 of the right and left side supports 30 and 31), arranged in outward direction (by still considering that the point of view is from the inside of the building to which the aperture on which the roller shutter is mounted belongs) with respect to the lower terminal aperture of the right or left upper terminal side support 72 or 74: the lower perforated cylinder of the two right and left upper terminal side supports 72 and 74 inserts into the pair of upper circular slots 35 of the right and left side supports 30 and 31 of the top tiltable intermediate slat 10', keeping the lower terminal aperture of the two right and left upper terminal side supports 72 and 74 and the upper terminal aperture 33 of such right and left side supports 30 and 31 free to allow the belt 40 to pass, whereby the two right and left upper terminal side supports 72 and 74 are hingedly coupled to such right and left side supports 30 and 31 participating along with the right and left side supports 30 and 31 of the tiltable intermediate slats 10 in forming two chains. Other embodiments of the roller shutter according to the invention may have one piece making the assembly of the upper terminal slat 70 and the two right and left upper terminal side supports 72 and 74, whereby such one piece is coupled through hinge coupling means to the two right and left side supports 30 and 31 of the top tiltable intermediate slat 10'.

The first embodiment of the roller shutter according to the invention further includes a lower terminal slat 80, that is non-tiltable, that is adjacent to a bottom tiltable intermediate slat 10'', since the former is arranged just below the latter. The lower terminal slat 80 is coupled to two right and left lower terminal side supports 82 and 84 (also configured to slide within standard side guides 50), advantageously similar to the right and left side supports 30 and 31 to which the tiltable intermediate slats 10 are rotatably coupled, and which are configured to couple to the right and left side supports 30 and 31 of the bottom tiltable intermediate slat 10''. In this regard, the lower terminal slat 80 is coupled at a fixed angle to the two right and left lower terminal side supports 82 and 84, and it is thus devoid of the right and left covers 20 and 21. To this end, in the first embodiment of the roller shutter according to the invention two self-tapping screws 39 are configured to be screwed into the two right and left lower terminal side supports 82 and 84 and into the hole of a perforated rib 17 with which also the lower terminal slat 80 is provided. (At least) one proximal inner ledge and (at least) one proximal outer ledge protrude from each one of the two right and left lower terminal side supports 82 and 84 (whereby the proximal inner and outer ledges protrude towards the lower terminal slat 80); in Figure 10b the proximal inner ledge 85 and the proximal outer ledge 86 of the left lower terminal side support

84 are visible. By means of such proximal inner and outer ledges, the two right and left lower terminal side supports 82 and 84 are configured to couple through snap-fit elastic connection (more optionally in a removable way) to the right and left ends of the lower terminal slat 80 so that the lower terminal slat 80 is constrained by the proximal inner and outer ledges of the two right and left lower terminal side supports 82 and 84 (in turn constrained within the respective side guides 50) whereby the lower terminal slat 80 is consequently coupled at a fixed angle to the two right and left lower terminal side supports 82 and 84. In the first embodiment of the roller shutter according to the invention the proximal inner and outer ledges of the two right and left lower terminal side supports 82 and 84 couple externally to the ends of the lower terminal slat 80; however, it must be noted that other embodiments may have different coupling arrangements, wherein for instance the proximal inner and outer ledges of the two right and left lower terminal side supports 82 and 84 couple internally to the ends of the lower terminal slat 80 (in this case, the proximal inner and outer ledges are shaped so as to not interfere with the perforated rib 17 of the lower terminal slat 80). Also, in the first embodiment of the roller shutter according to the invention, the two right and left lower terminal side supports 82 and 84 are provided with an upper terminal aperture similar (or identical) to the upper terminal aperture 33 of the right and left side supports 30 and 31 to allow the belt 40 to pass through itself; the two right and left lower terminal side supports 82 and 84 are also provided with a pair of upper circular slots (similar or identical to the upper circular slots 35 of the right and left side supports 30 and 31), arranged at the sides of the upper terminal aperture of the right or left lower terminal side support 82 or 84 and in outward direction with respect to the latter (by still considering that the point of view is from the inside of the building to which the aperture on which the roller shutter is mounted belongs): the pair of upper circular slots of the two right and left lower terminal side supports 82 and 84 are flanked to the lower perforated cylinder 36 of the right and left side supports 30 and 31 of the bottom tiltable intermediate slat 10'', keeping the upper terminal aperture of the two right and left lower terminal side supports 82 and 84 and the lower terminal aperture 34 of such right and left side supports 30 and 31 free to allow the belt 40 to pass, whereby the two right and left lower terminal side supports 82 and 84 are hingedly coupled to such right and left side supports 30 and 31 participating along with the right and left side supports 30 and 31 of the tiltable intermediate slats 10 and with the two right and left upper terminal side supports 72 and 74 in forming the two chains of side supports. Other embodiments of the roller shutter according to the invention may have one piece making the

assembly of the lower terminal slat 80 and the two right and left lower terminal side supports 82 and 84, whereby such one piece is coupled through hinge coupling means to the two right and left side supports 30 and 31 of the bottom tiltable intermediate slat 10''.

The upper terminal slat 70, and consequently the curtain of the first embodiment of the roller shutter according to the invention, is coupled to a conventional upper drum 60 through telescopic coupling means comprising a pulling slat 90, connected to the drum 60 by means of conventional belts (or ropes) 65, and a sliding element 95, configured to allow the latter to slide inside and outside the upper terminal slat 70. As particularly shown in Figure 7, to this end the upper terminal slat 70 is provided with a slot 71 on the upper edge 73 through which the sliding element 95 slides; the latter is provided with a lower stop component 96, configured to abut and interact with the upper edge 73 of the upper terminal slat 70, and with a upper hook-shaped component 97 (wherein such hook is directed downwards) configured to interact with a corresponding lower hook-shaped component 97 of the pulling slat 90 (wherein such hook is directed upwards), while a lower cap 92, positioned above the lower component 91, creates (along with the lower component 91) in the pulling slat 90 a lower housing seat for the upper component 97 of the sliding element 95 in which, once slidably inserted from a side end of the pulling slat 90, the same upper component 97 is stably bound (i.e. constrained at a fixed position in relation to the pulling slat 90).

In this way, the sliding element 95 is slidable inside and outside the upper terminal slat 70 between two limit positions: a first limit position, shown in Figures 6a, 6b, 7a, 8, 9a and 10a, wherein the sliding element 95 is at the position of maximum extension outside the upper terminal slat 70, and a second limit position, shown in Figures 6c, 7b, 9b and 10b, wherein the sliding element 95 is at the position of maximum insertion inside the upper terminal slat 70. In the first limit position of the sliding element 95, its own lower stop component 96 abuts with the upper edge 73 of the upper terminal slat 70; in the second limit position of the sliding element 95, the lower hook-shaped component 97 and a lower outer edge 93 of the pulling slat 90 abut with the upper edge 73 of the upper terminal slat 70.

The lower stop component 96 is integrally coupled to an upper end 45 of each one of the two belts 40 housed and slidably within the right and left side supports 30 and 31 of the tiltable intermediate slats 10, as well as within the two right and left upper terminal side supports 72 and 74 of the upper terminal slat 70; the lower ends of the two belts 40 are advantageously housed and slidably within the two right and left lower terminal side supports 82 and 84 of the

lower terminal slat 80.

Other embodiments of the roller shutter according to the invention may comprise constraining mechanical means interacting with each other different from the lower stop component 96 interacting with the upper edge 73 of the upper terminal slat 70 (e.g. mutually
5 interacting hook-shaped components) and from the upper and lower hook-shaped components 97 and 91 (e.g. stop components configured to abut and interact with retention components).

In this regard, when the two self-tapping screws 39 are screwed, respectively, into the two right and left upper terminal side supports 72 and 74 and into the ends of the hole of the perforated rib 17 of the upper terminal slat 70, the latter is constrained by the sliding element
10 95 and is consequently coupled at a fixed angle to the two right and left upper terminal side supports 72 and 74. Moreover, in the second limit position shown in Figures 6c, 7b, 9b and 10b, wherein the sliding element 95 is at the position of maximum insertion in the upper terminal slat 70, the two ends of the sliding element 95 (that in the preferred embodiment of the roller shutter shown in Figures 1-10 is larger than the upper terminal slat 70) insert into an upper
15 recess of the two right and left upper terminal side supports 72 and 74 (in Figures 6 and 10b the recess 75 of the left upper terminal side support 74 is visible).

The curtain of the roller shutter according to the invention is configured to wind up on the drum 60, advantageously positioned internally with respect to the wall to which the aperture to which the same roller shutter is applied belongs (i.e. inside the building to which the aperture
20 belongs): the rotations of the drum 60 cause a movement of the curtain upwards or downwards (depending on the direction of rotation of the drum) thanks to the sliding of the ends of the curtain (of which the right and left side supports 30 and 31, the two right and left upper terminal side supports 72 and 74 and the two right and left lower terminal side supports 82 and 84 are part) within the side guides 50. The position of the drum 60 is not an essential feature for the
25 present invention, and the roller shutter according to the invention may be configured to wind up on a drum positioned externally with respect to the wall to which the aperture to which the same roller shutter is applied belongs (i.e. outside the building to which the aperture belongs). The rotation of the drum 60 may be controlled by a user by manually operating on mechanical devices, such as a belt secured to an upper pulley (integrally coupled to the drum 60) and to a
30 lower winder with elastic return spring, or a hand crank coupled to one or more motion transmission elements such as joints, rods, and couplings which transmit the hand crank motion to an upper hoist (coupled to the drum 60), or by activating an electric motor that puts a shaft

integrally coupled to the drum 60 into rotation.

In order to better understand the invention, the operation modes of the first embodiment of the roller shutter with tiltable slats according to the invention are described in the following, similar modes also applying to the other embodiments.

5 The curtain of the roller shutter shown in Figures 1-10 may assume a configuration fully wound on the drum 60 and a fully deployed and screening configuration in which the curtain occupies the whole space of the aperture of the wall on which the roller shutter according to the invention is applied, whereby the lower terminal slat 80 rests on the floor (e.g. on the threshold of the aperture, such as the sill of a window or door) and supports the weight of the whole
10 curtain. In particular, when the curtain of the roller shutter assumes the fully deployed and screening configuration (as shown in Figures 9a and 10a), the aperture of the wall on which the roller shutter is applied is entirely closed since the curtain has substantially no gap through which light can pass from the outside to the inside of the aperture on which the roller shutter is mounted.

15 Starting from the configuration fully wound (or even from a configuration partially wound) on the drum 60, a rotation of the drum 60 causes the movement of the curtain downwards thanks to the sliding of the ends of the curtain within the side guides 50 until the curtain assumes the fully deployed and screening configuration; in such fully deployed and screening configuration (as well as in a configuration at least partially wound on the drum 60),
20 the sliding element 95 assumes the first limit position (shown in Figures 6a, 6b, 7a, 8, 9a and 10a) wherein all the tiltable intermediate slats 10 (including the top and bottom ones 10' and 10'') are aligned to the respective right and left side supports 30 and 31 (whereby the rotation angle is equal to 0°), i.e. they have the same alignment of the pulling slat 90 and of the upper and lower terminal slats 70 and 80.

25 In particular, when the curtain assumes the fully deployed and screening configuration, the pulling slat 90 is constrained by the interaction of the upper hook-shaped component 97 of the sliding element 95 with its housing seat in the pulling slat 90 created by the lower hook-shaped component 97 and by the lower cap 92. Hence, the pulling slat 90 is positioned at the maximum distance with respect to the upper terminal slat 70 since the belts 40, constrained by
30 their interaction with the perforated toothed pivots of the tiltable intermediate slats 10, are configured to support the weight of the pulling slat 90 and, consequently, to counteract the latter when it gets closer to the upper terminal slat 70. The belts or ropes 65 connecting the

pulling slat 90 to the drum 60 have such length that, in such fully deployed and screening configuration, they are loose (instead of being stretched).

When the curtain of the roller shutter assumes the fully deployed and screening configuration, the tiltable intermediate slats 10 may be tilted by pushing (for instance manually) from inside the building to which the aperture belongs the lower portion of (at least) one tiltable intermediate slat 10, i.e. the portion of the central body 11 that is below the perforated toothed pivot 22 of the right and left covers 20 and 21 coupled to the tiltable intermediate slat 10 under consideration. By particularly referring to Figure 3, this causes the tiltable intermediate slat 10 being pushed to rotate, and consequently the right and left covers 20 and 21 coupled thereto also rotate, producing the rotation of the related perforated toothed pivots 22 within the right and left side supports 30 and 31 to which such tiltable intermediate slat 10 is rotatably coupled. Such perforated toothed pivots 22 interact with the respective toothed elements 41 of the belts 40 (implementing a sort of rack and pinion mechanism) housed within the right and left side supports 30 and 31 and they drag the same belts 40 downwards, whereby the sliding element 95 (coupled to the upper end 45 of the belts 40) slides downwards starting from the first limit position (shown in Figures 6a, 6b, 7a, 8, 9a and 10a), being progressively inserted into the upper terminal slat 70 and dragging the pulling slat 90 downwards towards the same upper terminal slat 70. The two belts 40, by sliding downwards within the right and left side supports 30 and 31 to which all the other tiltable intermediate slats 10 are rotatably coupled, transmit, by means of the toothed elements 41 with which they are provided, the rotation of the perforated toothed pivots 22 of (the right and left covers 20 and 21 coupled to) the tiltable intermediate slat 10 being pushed to the perforated toothed pivots 22 of (right and left covers 20 and 21 coupled to) all the other tiltable intermediate slats 10, causing all the other tiltable intermediate slats 10 to also tilt by the same rotation angle, with respect to the respective right and left side supports 30 and 31, by which the tiltable intermediate slat 10 being pushed has been rotated. The maximum allowed rotation of the tiltable intermediate slats 10 is limited by (besides, obviously, the diameter of the perforated toothed pivots 22) the length of the maximum sliding of the sliding element 95 downwards, starting from the first limit position down to the second limit position, shown in Figures 6c, 7b, 9b and 10b, in which the sliding element 95 is at the position of maximum insertion into the upper terminal slat 70, with the lower hook-shaped component 97 and the lower outer edge 93 of the pulling slat 90 abutting with the upper edge 73 of the upper terminal slat 70 (preventing the sliding element 95 from further sliding downwards). In

particular, Figure 6b shows the sliding element 95 at the first limit position with a left belt 40 and the related toothed elements 41 interacting with the perforated toothed pivots 22 of the left covers 21, while Figures 6c and 10b show the sliding element 95 at the second limit position with the belt 40 and the related toothed elements 41.

5 Figures 5, 7b, 8b and 9b show the tiltable intermediate slats 10 tilted by the maximum rotation angle with respect to the respective right and left side supports 30 and 31 for the first embodiment of the roller shutter according to the invention, equal to 120° . Figures 6a, 7a, 8, 9a and 10a show the tiltable intermediate slats 10 in the basic orientation in which they are aligned to the respective right and left side supports 30 and 31, whereby they are tilted by a rotation
10 angle equal to 0° . When the tiltable intermediate slats 10 are tilted by a rotation angle that is intermediate between the maximum one and the null one (i.e. 0°), the sliding element 95 is partially inserted into the upper terminal slat 70.

As shown in Figure 7a, in the first embodiment of the roller shutter according to the invention, a rotation in the opposite direction of the tiltable intermediate slats 10 is prevented
15 by, besides the interaction of the lower stop component 96 of the sliding element 95 that abuts with the upper edge 73 of the upper terminal slat 70, the opposite curvilinear outlines of the upper projecting inner wing 12 and the lower projecting outer wing 14 of the central body 11 of the tiltable intermediate slats 10 as well.

When the tiltable intermediate slats 10 are tilted with respect to the right and left side
20 supports 30 and 31 by a rotation angle larger than 0° , to make them return to the basic orientation (in which they are aligned to the respective right and left side supports 30 and 31 and such rotation angle is equal to 0°) it is sufficient to rotate the drum 60 so as to make the curtain wind up on the same drum. In fact, the upper hook-shaped component 97 of the sliding element 95 interacts with the lower hook-shaped component 97 of the pulling slat 90, whereby
25 a rotation of the drum 60 raises both the pulling slat 90 and the sliding element 95 and, consequently, the upper end 45 of each one of the two belts 40 housed within the right and left side supports 30 and 31 of the tiltable intermediate slats 10. This causes the two belts 40 and the related toothed elements 41 to slide upwards within the right and left side supports 30 and 31, causing the rotation of the toothed pivots 22 of the right and left covers 20 and 21 of all the
30 tiltable intermediate slats 10 until these returns to the basic orientation, with tilting angle equal to 0° (as shown in Figures 6a, 7a, 8, 9a and 10a); in particular, the tiltable intermediate slats 10 are in the basic orientation when the lower stop component 96 of the sliding element 95 abuts

with the upper edge 73 of the upper terminal slat 70.

Finally, thanks to the interaction of the lower stop component 96 of the sliding element 95 with the upper edge 73 of the upper terminal slat 70 and to the chain formed by the right and left upper terminal side supports 72 and 74, the right and left side supports 30 and 31 and the right and left lower terminal side supports 82 and 84, a further rotation of the drum 60 raises the whole curtain, i.e. the pulling slat 90, the sliding element 95, the upper terminal slat 70, the tiltable intermediate slats 10 (including the top and bottom tiltable intermediate slats 10' and 10'') and the lower terminal slat 80. When the tiltable intermediate slats 10 are raised (i.e. pulled by the drum 60 from which they are hung), they may only assume the basic orientation, since the upper end of each belt 40 is also pulled by, and thus constrained to, the sliding element 95, whereby it may not slide downwards within the right and left side supports 30 and 31 of the tiltable intermediate slats 10.

By turning to make reference to Figures 1-4, in the first embodiment of the roller shutter according to the invention, each toothed element 41 is provided with an upper stop element 42 configured to abut with the lower perforated cylinder of the side support that is adjacent and above the support within which the toothed element 41 under consideration is housed; in particular, in the case where the toothed element 41 is housed within the (right or) left side support (30 or) 31 of the top tiltable intermediate slat 10', its upper stop element 42 is configured to abut with the lower perforated cylinder of the (right or) left upper terminal side support (72 or) 74, while the toothed elements 41 housed within the (right or) left side supports (30 or) 31 of the other tiltable intermediate slats 10 have the upper stop elements 42 configured to abut with the lower perforated cylinders 36 of the (right or) left side supports (30 or) 31 which are adjacent and above. This allows not to force the perforated toothed pivots 22 during the curtain upward pull. In any case, such upper stop elements 42 are not essential features for the present invention.

Further embodiments of the roller shutter according to the invention may have a structure similar to that of the first embodiment of Figures 1-10, from which they slightly differ only for the structure of the pulling slat. In particular, the latter is devoid of the lower cap 92, whereby there is no housing seat within the pulling slat for the upper component 97 of the sliding element 95, which upper component 97 is consequently not stably constrained to the pulling slat. In other words, the sliding element 95 is constrained to the pulling slat through the interaction of the upper hook-shaped component 97 with the corresponding lower hook-shaped

component 97 of the pulling slat, but not at a fixed position. In such case, the sliding element 95 is configured to slide inside and outside the pulling slat between two limit positions: a first limit position at which the sliding element 95 is at the position of maximum insertion inside the pulling slat, and a second limit position at which the sliding element 95 is at the position of maximum extension outside the pulling slat. Even in this case, the sliding element 95 is configured to further slide inside and outside the upper terminal slat 70, through the slot 71 on the upper edge 73, and it is provided with the lower stop component 96, configured to abut and interact with the upper edge 73 of the upper terminal slat 70 at the first limit position. At the second limit position of the sliding element 95, its upper hook-shaped component 97 interacts with the lower hook-shaped component 97 of the pulling slat. In particular, when the curtain of the roller shutter assumes a fully deployed and screening configuration (similar to the one shown in Figures 9a and 10a), the pulling slat is positioned (by falling due to its own weight) at the minimum distance (optionally substantially null) from the upper terminal slat 70, and the sliding element 95 assumes the first limit position at which it is at the position of maximum insertion inside the pulling slat and all the tiltable intermediate slats 10 (including the top and bottom ones 10' and 10'') are aligned to the respective right and left side supports 30 and 31 (whereby the rotation angle is equal to 0°). When the curtain of the roller shutter assumes the fully deployed and screening configuration, the tiltable intermediate slats 10 may be also tilted similarly to the roller shutter of Figures 1-10: during the rotation of the tiltable intermediate slats 10, the belts 40 housed within the right and left side supports 30 and 31 are dragged downwards, whereby the sliding element 95 (coupled to the upper end 45 of the belts 40) slides downwards starting from the first limit position, progressively exiting from the pulling slat and being inserted into the upper terminal slat 70. Similarly to the roller shutter of Figures 1-10, when the tiltable intermediate slats 10 are tilted with respect to the right and left side supports 30 and 31 by a rotation angle larger than 0°, to make them return to the basic orientation (in which they are aligned to the respective right and left side supports 30 and 31 and such rotation angle is equal to 0°) it is sufficient to rotate the drum 60 so as to make the curtain wind up on the same drum: the initial rotation of the drum 60 raises only the pulling slat until its lower hook-shaped component 97 interferes with the upper hook-shaped component 97 of the sliding element 95 (in the case where the tiltable intermediate slats 10 are tilted by the maximum rotation angle, the sliding element 95 is already at its first limit position at which its upper hook-shaped component 97 interacts with the lower hook-shaped component 97 of the pulling slat);

afterwards, a further rotation of the drum 60 raises both the pulling slat and the sliding element 95 and, consequently, the upper end 45 of each one of the two belts 40 housed within the right and left side supports 30 and 31 of the tiltable intermediate slats 10, causing the two belts 40 and the related toothed elements 41 to slide upwards within the right and left side supports 30 and 31, and producing the rotation of the toothed pivots 22 of the right and left covers 20 and 21 of all the tiltable intermediate slats 10 until they return to the basic orientation, with tilting angle equal to 0° (the tiltable intermediate slats 10 are in the basic orientation when the lower stop component 96 of the sliding element 95 abuts with the upper edge 73 of the upper terminal slat 70).

Other embodiments of the roller shutter with tiltable slats according to the invention may have different shapes and structures of the tiltable intermediate slats and/or of the upper and/or lower terminal slats (the upper and lower terminal slats could be even missing), and/or of the telescopic means of coupling the curtain to the drum and/or different arrangements of the belts within the right and left side supports and/or different directions of rotation allowed for the tiltable intermediate slats. By way of mere example, and not by way of limitation, the telescopic means could comprise a slide movable only within the pulling slat 90 between two limit positions and integrally coupled to the belts 40, and the upper terminal slat could be missing.

By way of mere example, and not by way of limitation, Figures 11-13 show a left portion of a second embodiment of the roller shutter with tiltable slats according to the invention, still assuming that the point of view of the roller shutter is the one indicated in the Figures by the arrow IN, i.e. from the inside of the aperture to which the same roller shutter is applied (i.e. from the inside of the building to which the aperture belongs).

The second embodiment of the roller shutter according to the invention comprises a plurality of tiltable intermediate slats 100. The two right and left ends of each tiltable intermediate slat 100 are provided with a respective right cover (not shown) and a respective left cover 210, specularly symmetrical to each other, both provided with a side toothed pivot 220, parallel to the longitudinal axis of the tiltable intermediate slats 100 (where the longitudinal axis of the tiltable intermediate slats 100 is orthogonal to the sliding direction upwards and downwards of the same slats), ending with a toothless cylindrical end 240, that protrudes in opposite direction to the end of the tiltable intermediate slat 100 to which the left cover 210 is coupled (whereby the toothed pivot 220 is distal with respect to the tiltable intermediate slat

100).

The right cover and the left cover 210 are coupled, optionally in a removable way, to the right and left ends, respectively, of a respective tiltable intermediate slat 100, advantageously through a snap-fit connection. In the second embodiment of the roller shutter according to the invention, when a right or left cover 210 is coupled to a respective right or left end of a tiltable intermediate slat 100, its toothed pivot 220 is arranged in correspondence of a mass centroid, coinciding with the geometrical centroid, of the cross-section (along a plane orthogonal to the longitudinal axis of the tiltable intermediate slats) of the tiltable intermediate slat 100; as already stated, in other embodiments of the roller shutter according to the invention, the toothed pivot may be arranged at positions different from such centroids (which centroids may be also not coinciding). In particular, the tiltable intermediate slats 100 and the right and left covers 210 optionally have similar transverse sections. Each tiltable intermediate slat 100 comprises a profile having a central body 110, that is optionally hollow, from which an upper projecting outer wing 120, with curvilinear outline such that it directs the end 130 inwards, and a lower projecting inner wing 140, with curvilinear outline such that it directs the end 150 outwards. Moreover, the outer surface of the central body 110 of the end of the tiltable intermediate slat 100 is provided with an external linear groove 160 parallel to the longitudinal axis of the same tiltable intermediate slat 100 and that runs the entire length thereof; in other embodiments, the external linear groove 160 may be present only on the end portions of the tiltable intermediate slat 100.

By referring to the left covers 210 shown in Figures 11-13 and noting that the right covers are specularly symmetrical to the left ones 210, each left cover 210 comprises a transverse shaped plate 250 from which a proximal inner surface 260 and a proximal outer surface 270 protrude, i.e. which protrude towards the tiltable intermediate slat 100. Such proximal inner surface 260 is shaped so as to correspond to the inner outline of the central body 110 and of the lower projecting inner wing 140 of the tiltable intermediate slat 100, while such proximal outer surface 270 is shaped so as to correspond to the outer outline of the central body 110 and of the upper projecting outer wing 120 of the tiltable intermediate slat 100; also, the proximal outer surface 270 has an internal linear projection 280 that runs it, that is parallel to the toothed pivot 220 and that is configured to insert into the external linear groove 160 of the tiltable intermediate slat 100. Thanks to such corresponding outlines, a right cover and a left cover 210 are coupled through snap-fit elastic connection, optionally in a removable way, to the right and

left ends, respectively, of a respective tiltable intermediate slat 100.

The toothed pivot 220 of the left cover 210 of each tiltable intermediate slat 100 inserts into a proximal through hole 320 of a respective left side support 321 (i.e. arranged on a wall that is "proximal" with respect to the tiltable intermediate slat 100 and the left cover 210), further provided with a distal through hole (i.e. arranged on a wall that is "distal" with respect to the tiltable intermediate slat 100 and the left cover 210) into which the cylindrical end 240 of the toothed pivot 220 inserts, the length of which is substantially equal to the distance between the proximal and distal through holes 320 of the left side support 321. In this regard, the teeth of the toothed pivot 220, which project with respect to the surface of the cylindrical end 240, and the base 290 of the toothed pivot 220, that projects with respect to the height of the teeth of the latter, operate as stop elements of the left cover 210 in the insertion of the toothed pivot 220 into the proximal and distal through holes 320 of the left side support 321, whereby the toothed pivot 220 of the left cover 210 cannot insert into such proximal and distal through holes 320 of the left side support 321 beyond a limit position. When the toothed pivot 220 of the left cover 210 is inserted into the proximal and distal through holes 320 of the left side support 321, the left cover 210 and the respective tiltable intermediate slat 100 to which it is coupled are rotatably coupled to the left side support 321. In the preferred embodiment, the height of the left side support 321 is substantially equal to the height of the respective tiltable intermediate slat 100.

The left side support 321 is provided with an upper terminal aperture 33 and a lower terminal aperture 34 configured to allow a toothed belt 400 to pass, the teeth of which are configured to interact with the teeth of the toothed pivot 220 of the left cover 210 that is inserted into the left side support 321. In particular, as shown in Figures 11 and 12 (where only part of the toothed belt 400 is shown), the left side support 321 is configured to make the toothed belt 400 pass so that the latter is arranged at a position offset towards the outside (of the building to which the aperture belongs) with respect to the position of the toothed pivot 220 and that the teeth thereof are directed outwards, i.e. towards the toothed pivot 220, to interact with the latter. The left side support 321 is configured to allow the toothed belt 400 to slide upwards and downwards with respect to it. In particular, the toothed belt 400 is flexible, whereby it is configured to follow the winding of the roller shutter on a drum (not shown in Figures 11-13). In other embodiments of the roller shutter according to the invention, the toothed belt could be made as a chain formed by a plurality of toothed components hinged to

each other and advantageously having length substantially equal to the height of the tiltable intermediate slats 100, and in this case the individual components of the chain that forms the toothed belt could be also not flexible.

As shown in Figures 11 and 12, each left side support 321 is configured to be coupled, optionally in a removable way, to two identical adjacent left side supports 321, positioned one above and one below the left side support 321 under consideration. By turning to make reference also to Figure 13, in the second embodiment of the roller shutter according to the invention, each left side support 321 is attached to two identical adjacent left side supports 321 through a pair of upper circular slots 35, arranged at the sides of the upper terminal aperture 33, and a pair of lower circular slots 360, arranged at the sides of the lower terminal aperture 34: as better shown in Figures 11 and 12, the pair of upper circular slots 35 of a first left side support 321 are flanked to the pair of lower circular slots 360 of a second left side support, that is adjacent and above the first one, with the pair of upper circular slots 35 (of the first one) which are positioned externally to the pair of lower circular slots 360 (of the second one) with respect to the upper terminal aperture 33 of the first one (and to the lower terminal aperture 34 of the second one), while the pair of lower circular slots 360 of the first left side support 321 are flanked to the pair of upper circular slots 35 of a third left side support, that is adjacent and below the first one, with the pair of lower circular slots 360 (of the first one) which are positioned internally to the pair of upper circular slots 35 (of the third one) with respect to the lower terminal aperture 34 of the first one (and to the upper terminal aperture 33 of the third one). The adjacent left side supports 321 may be rotatably coupled to one another, namely with a hinge coupling, by inserting coupling components, optionally removable ones, such as screws and washers, rivets and washers, or nuts and bolts into the flanked slots. In this way, as shown in Figures 11 and 12, the pairs of upper circular slots 35 and the pairs of lower circular slots 360 operate as hinges which allow the reciprocal rotation of the adjacent left side supports 321 which, in this way, form a chain.

Similarly to the right and left covers 210, also the right and left side supports 321 are specularly symmetrical to each other, whereby the modes of coupling a right side support to a respective right cover 20, as well as the modes of coupling adjacent right side supports, are completely identical. As shown in Figures 11 and 12, the left side supports 31, and similarly the right side supports, are configured to slide within conventional side guides 50 mounted on two side flanks of the wall which delimit the aperture to which the roller shutter with tiltable slats

according to the invention is applied.

In the second embodiment of the roller shutter according to the invention, that comprises an upper terminal slat and telescopic means for coupling the latter and the toothed belt 400 to the drum similar to those of the first embodiment shown in Figures 1-10, the modes of tilting the tiltable intermediate slats 100 are similar to the ones of the first embodiment, but the rotation occurs in opposite direction with respect to the one of the tiltable intermediate slats 10 of the first embodiment. In fact, when the curtain of the roller shutter assumes the fully deployed and screening configuration, the tiltable intermediate slats 100 may be tilted by pushing (for instance manually), from the inside of the building to which the aperture belongs, the upper portion, instead of the lower one, of (at least) one tiltable intermediate slat 100, i.e. the portion of the central body 110 that is above the perforated toothed pivot 220 of the right and left covers 210 coupled to the tiltable intermediate slat 100 under consideration. This causes the tiltable intermediate slat 100 being pushed to rotate, and consequently also the right and left covers 210 coupled thereto rotate, causing the rotation of the related perforated toothed pivots 220 within the right and left side supports 310 to which such tiltable intermediate slat 100 is rotatably coupled. Such perforated toothed pivots 220 interact with the respective toothed belts 400 housed within the right and left side supports 310 and drag them downwards, whereby they transmit the rotation of the perforated toothed pivots 220 of (the right and left covers 210 coupled to) the tiltable intermediate slat 100 being pushed to the perforated toothed pivots 220 of (right and left covers 210 coupled to) all the other tiltable intermediate slats 100, causing all the other tiltable intermediate slats 100 to tilt by the same rotation angle, with respect to the respective right and left side supports 310, by which the tiltable intermediate slat 100 being pushed has been rotated.

Other embodiments of the roller shutter according to the invention may comprise a belt devoid of teeth that mechanically interacts with the pivots, which are not necessarily toothed, of right or left covers so as to transform the rotational motion of the pivot into a translational motion of the belt and vice versa; by way of example and not by way of limitation, the belt may be constrained to each one of the pivots, for instance in correspondence of a slot thereof, whereby when a tiltable intermediate slat rotates and, consequently, the related right and left pivots rotate, these drag the respective right and left belts which, in turn, make all the other right and left pivots, respectively, of the other tiltable intermediate slats rotate. Obviously, when the belts are dragged upwards (e.g. by a pulling slat similar to the one shown in Figures 6-10),

they make all the pivots and, consequently, all the tiltable intermediate slats rotate, bringing back the curtain to assume the fully deployed and screening configuration.

Further embodiments of the roller shutter with tiltable slats according to the invention may comprise some additional slats which are non-tiltable, and which may possibly be made similarly to the upper or lower terminal slats; such additional non-tiltable slats may be arranged at any position, in the curtain, both at at least one of the two ends (for instance above the pulling slat 90 of Figures 6-10) and at positions interposed between tiltable intermediate slats.

Other embodiments of the roller shutter with tiltable slats according to the invention may have an automatic tilting of the tiltable intermediate slats each time that the curtain of the roller shutter assumes the fully deployed and screening configuration.

To this end, in the first embodiment of the roller shutter of Figures 1-10, it is sufficient to replace the belts or ropes 65 connecting the pulling slat 90 to the drum 60 with semi-rigid elements, configured to assume only one linear configuration or a configuration wound on the drum 60, so that, as soon as the curtain assumes the fully deployed and screening configuration (in which the lower terminal slat 80 rests on the floor and supports the weight of the whole curtain), such semi-rigid elements push the pulling slat 90 downwards towards the upper terminal slat 70, making the sliding element 95 to insert inside the latter and making the belts 40 slide downwards causing a rotation of all the perforated toothed pivots 22 and, consequently, of all the tiltable intermediate slats 10 up to the maximum rotation angle with respect to the respective right and left side supports 30 and 31.

Alternatively, it is sufficient that the axis of the (perforated) toothed pivot is below the centroid of one or more respective tiltable intermediate slats: each time that the curtain comes to assume the fully deployed and screening configuration, the same weight of said one or more tiltable intermediate slats will make these rotate and, consequently, the (perforated) toothed pivots of the related covers drag the belt provided with toothed elements (or the toothed belt) up to the maximum angle orientation allowed for the slats (not larger than 180°). To this end, it is advantageous that the centroid of said one or more tiltable intermediate slats, besides being above the axis of the (perforated) toothed pivot of the respective covers, is also offset from the vertical plane passing through the pivot inwards (in the case where the direction of rotation of the tiltable intermediate slats is the one of the first embodiment shown in Figures 1-10) or outwards (in the case where the direction of rotation of the tiltable intermediate slats is the one of the second embodiment shown in Figures 11-13). It is possible to apply a weight inside or

outside one or more tiltable intermediate slats to obtain their automatic tilting as just described. Such embodiments may be advantageously provided with elements for stopping tilting of the tiltable intermediate slats to disable their automatic tilting. In particular, similar elements for stopping tilting of the tiltable intermediate slats which prevent them from tilting may be present
5 also in other embodiments of the roller shutter according to the invention.

Further embodiments of the roller shutter with tiltable slats according to the invention may be moved by an electric motor.

Other embodiments of the roller shutter with tiltable slats according to the invention may be devoid of the right and left covers, whereby the (perforated) toothed pivot is integrated
10 at the end of each tiltable intermediate slat.

Further embodiments of the roller shutter with tiltable slats according to the invention may have tiltable intermediate slats of different heights (for instance for aesthetic purposes), provided that also the possible covers and the side supports have the same height of the respective slats, and that the toothed pins of all the tiltable intermediate slats have the same
15 size and the same pitch of the teeth in order to tilt all the tiltable intermediate slats by the same rotation angle with respect to the side supports.

Other embodiments of the roller shutter with tiltable slats according to the invention may have a lower terminal slat operating similarly to the upper terminal slat of the first embodiment shown in Figures 1-10, whereby the belt provided with the toothed elements (or
20 the toothed belt), when dragged by the rotation of a (perforated) toothed pivot associated to a tiltable intermediate slat being pushed, slides upwards, instead of downwards, within the right and/or left side supports. In this case, adaptations are necessary which are within the reach of those skilled in the art, such as for instance the use of telescopic coupling means between the lower terminal slat and the lower end of the belts.

25 The preferred embodiments of this invention have been described and a number of variations have been suggested hereinbefore, but it should be understood that those skilled in the art can make other variations and changes without so departing from the scope of protection thereof, as defined by the attached claims.

CLAIMS

1. Roller shutter comprising a curtain having two sides and configured to be wound on a drum (60), whereby the curtain is configured to assume a configuration fully wound on a drum (60) and a fully deployed and screening configuration in which it occupies an aperture of the wall
5 on which the roller shutter is applied, the curtain comprising a plurality of tiltable intermediate slats (10; 100) each having two side ends each provided with a respective side pivot (22; 220) that protrudes from the respective side end and that inserts into a respective side support (30; 31; 321), whereby each tiltable intermediate slat (10; 100) is rotatably coupled to a pair of respective side supports (30; 31; 321), the side supports (30; 31; 321) which are rotatably
10 coupled to the tiltable intermediate slats (10; 100) on a same side of the curtain being coupled to each other through hinge coupling means (35, 36; 360) so as to form a side chain configured to slide in a respective side guide (50), each side chain housing a drive belt (40, 41; 400) that is configured to slide within the side supports (30; 31; 321) and to interact with the side pivots (22; 220) so as to transform the rotational motion of the side pivots (22; 220) into a translational
15 motion of the drive belt (40, 41; 400) and vice versa, the curtain further comprising telescopic means (90, 95, 65) configured to cause the two drive belts (40, 41; 400) to assume a first limit position within the respective side chains, wherein the tiltable intermediate slats (10; 100) assume a basic orientation where they are aligned to the respective side supports (30; 31; 321), and a second limit position within the respective side chains, wherein the tiltable intermediate
20 slats (10; 100) assume a maximum angle orientation with respect to the respective side supports (30; 31; 321), whereby, when the curtain assumes the fully deployed and screening configuration, the tiltable intermediate slats (10; 100) are configured to assume any orientation ranging from the basic orientation to the maximum angle orientation upon a force applied on at least one of the tiltable intermediate slats (10; 100) causing a rotation of the respective side
25 pivots (22; 220) that is transmitted through the two drive belts (40, 41; 400) to the side pivots (22; 220) of all the other tiltable intermediate slats (10; 100).

2. Roller shutter according to claim 1, wherein the curtain further comprises a first non-tiltable terminal slat (70) that is adjacent to a tiltable intermediate slat (10') of a first end of the plurality of tiltable intermediate slats (10), the first terminal slat (70) being coupled to the two
30 side supports (30; 31) of the tiltable intermediate slat (10') of the first end, optionally through two first terminal side supports (72; 74), and wherein said telescopic means (90, 95, 65) comprises a pulling slat (90), configured to be coupled to a drum (60), and a sliding element (95)

configured to slide inside and outside the first terminal slat (70), through a slot (71) of the latter, to assume a first limit position, corresponding to the first limit position of the two drive belts (40, 41; 400), wherein the sliding element (95) is at the position of maximum extension outside the first terminal slat (70), and a second limit position, corresponding to the second limit position of the two drive belts (40, 41; 400), wherein the sliding element (95) is at the position of maximum insertion inside the first terminal slat (70), the sliding element (95) being integrally coupled to each one of the two drive belts (40, 41; 400).

3. Roller shutter according to claim 2, wherein the sliding element (95) is provided with a first hook-shaped component (97) configured to interact with a corresponding second hook-shaped component (91) of the pulling slat (90), the pulling slat further comprising a cap (92) that creates, along with the second component (91), a housing seat for the first component (97) in which the first component (97) is configured to be stably bound.

4. Roller shutter according to claim 1, wherein said telescopic means (90, 95, 65) comprises a pulling slat (90), configured to be coupled to a drum (60), and a slide configured to slide within the pulling slat (90) and to assume a first limit position, corresponding to the first limit position of the two drive belts (40, 41; 400), and a second limit position, corresponding to the second limit position of the two drive belts (40, 41; 400), said slide being integrally coupled to each one of the two drive belts (40, 41; 400).

5. Roller shutter according to any one of the preceding claims, wherein the side pivots (22; 220) of the tiltable intermediate slats (10; 100) are provided with teeth and the two drive belts (40, 41; 400) are provided with teeth configured to interact with the teeth of the side pivots (22; 220) of the tiltable intermediate slats (10; 100).

6. Roller shutter according to claim 5, wherein the two side ends of each tiltable intermediate slat (10) each comprise a respective side cover (20; 21) coupled to the respective side end, optionally through a snap-fit connection, wherein each side cover (20; 21) is provided with a side perforated toothed pivot (22) operating as side pivot with which the respective side end of the respective tiltable intermediate slat (10; 100) is provided, wherein the side perforated toothed pivot (22) protrudes from the respective side end and inserts into a first through hole (32) of a first side wall of a respective side support (30; 31), where the first side wall is proximal with respect to the tiltable intermediate slat (10), which side support (30; 31) is further provided with a second through hole (38) on a second side wall that is distal with respect to the tiltable intermediate slat (10), the first and second through holes (32, 38) being arranged substantially

coaxially with each other, wherein the second through hole (38) is configured to receive a screw (39), optionally a self-tapping one, that is configured to insert into the hole of the side perforated toothed pivot (22) of the respective side cover (20; 21) and into a hole of a perforated rib (17) of the respective tiltable intermediate slat (10), whereby when a screw (39) is fixed into the second through hole (38), the respective side cover (20; 21) and the respective tiltable intermediate slat (10) are rotatably coupled to the respective side support (30; 31), each side support (30; 31) being provided with a first terminal aperture (33) and a second terminal aperture (34) configured to allow a drive belt (40, 41; 400) to pass and slide.

7. Roller shutter according to claim 5, wherein the two side ends of each tiltable intermediate slat (100) each comprise a respective side cover (210) coupled to the respective side end, optionally through a snap-fit connection, wherein each side cover (210) is provided with a side toothed pivot (220), operating as side pivot with which the respective side end of the respective tiltable intermediate slat (10; 100) is provided, wherein the side toothed pivot (220) ends with a toothless cylindrical end (240), it protrudes from the respective side end, and it inserts into a first through hole (320) of a first side wall of a respective side support (30; 31), where the first side wall is proximal with respect to the tiltable intermediate slat (100), which side support (30; 31) is further provided with a second through hole on a second side wall that is distal with respect to the tiltable intermediate slat (100), whereby when the side toothed pivot (220) of the side cover (210) is inserted into the first and second through holes (320) of the respective side support (321), the respective side cover (210) and the respective tiltable intermediate slat (100) are rotatably coupled to the respective side support (321), each side support (30; 31) being provided with a first terminal aperture (33) and a second terminal aperture (34) configured to allow a drive belt (40, 41; 400) to pass and slide.

8. Roller shutter according to claim 6 or 7, wherein each side support (30; 31; 321) is formed by a main element (310), provided with the first and second through holes (32, 38; 320), and a lid (315) coupled through mechanical coupling means, optionally through snap-fit elastic connection, more optionally in a removable way, to the main element (310), wherein said mechanical coupling means is selected from the group comprising:

- pins (316) configured to insert into corresponding third holes (311),
- screws and washers,
- rivets and washers,
- nuts and bolts.

9. Roller shutter according to any one of claims 6 to 8, wherein said hinge coupling means (35, 36; 360) comprises a pair of circular slots (35) arranged alongside the first terminal aperture (33) and a perforated cylinder (36) arranged in correspondence of the second terminal aperture (34), whereby the pair of circular slots (35) of a first side support (30; 31; 321) are configured to place alongside and couple through coupling components, optionally removable ones, to the perforated cylinder (36) of a second side support (30; 31; 321), adjacent to the first one, maintaining the first terminal aperture (33) of the first side support (30; 31; 321) and the second terminal aperture (34) of the second side support (30; 31; 321) free so as to allow a drive belt (40, 41; 400) to pass and slide, wherein said coupling components are selected from the group comprising screws and washers, rivets and washers, nuts and bolts.

10. Roller shutter according to any one of claims 6 to 8, wherein said hinge coupling means (35, 36; 360) comprises a first pair of circular slots (35) arranged alongside the first terminal aperture (33) and a second pair of circular slots (360) arranged alongside the second terminal aperture (34), whereby the first pair of circular slots (35) of a first side support (30; 31; 321) are configured to place alongside and couple through coupling components, optionally removable ones, to the second pair of circular slots (360) of a second side support (30; 31; 321), adjacent to the first one, maintaining the first terminal aperture (33) of the first side support (30; 31; 321) and the second terminal aperture (34) of the second side support (30; 31; 321) free so as to allow a drive belt (40, 41; 400) to pass and slide, wherein said coupling components are selected from the group comprising screws and washers, rivets and washers, nuts and bolts.

11. Roller shutter according to any one of claims 5 to 10, wherein the drive belt is selected from the group comprising:

- a belt (40) provided with a plurality of toothed elements (41) coupled to the belt (40), each toothed element (41) being housed within a respective side support (30; 31; 321), each toothed element (41) being configured to interact with the teeth of the side pivot (22; 220) inserted into the respective side support (30; 31; 321), and
- a toothed belt (400).

12. Roller shutter according to any one of the preceding claims, wherein at least one of the tiltable intermediate slats (10; 100) is an unstable tiltable intermediate slat (10; 100) having a centroid offset with respect to an axis along which the respective side pivots (22; 220) are arranged, whereby when the curtain assumes the fully deployed and screening configuration the tiltable intermediate slats (10; 100) are oriented with the maximum angle orientation upon

rotation of said at least one unstable tiltable intermediate slat (10; 100) caused by the weight force of the latter, said at least one unstable tiltable intermediate slat (10; 100) being optionally provided with one or more weights.

13. Roller shutter according to any one of the preceding claims, further comprising at least one element for stopping the orientation of the tiltable intermediate slats (10; 100) configured to enable and disable the orientation of these.

14. Roller shutter according to any one of the preceding claims, wherein the curtain further comprises one or more terminal slats (70, 80) coupled to one or both the terminal ends of the plurality of tiltable intermediate slats (10; 100).

15. Kit of components for mounting a roller shutter according to any one of claims 1 to 14, comprising:

- a plurality of tiltable intermediate slats (10; 100) each having two side ends;
- a plurality of side covers (20; 21; 210), each provided with a respective side pivot (22; 220) configured to couple to a side end of a respective tiltable intermediate slat (10; 100),
- a plurality of side supports (30; 31; 321), each configured to receive a side pivot (22; 220) of a respective side cover (20; 21; 210), the side supports (30; 31; 321) being configured to couple to each other through hinge coupling means (35, 36; 360) so as to form at least two side chains,
- at least one drive belt (40, 41; 400) configured to be housed and to slide in at least one respective side chain, so as to interact with the side pivots (22; 220),
- telescopic means (90, 95, 65) configured to make said at least one drive belt (40, 41; 400) assume, when the tiltable intermediate slats (10; 100) are rotatably coupled to side supports (30; 31; 321) and two drive belts (40, 41; 400) are housed in two respective side chains, a first limit position inside said at least one respective side chain, wherein the tiltable intermediate slats (10; 100) assume a basic orientation where they are aligned to the respective side supports (30; 31; 321), and a second limit position inside said at least one respective side chain, wherein the tiltable intermediate slats (10; 100) assume a maximum angle orientation with respect to the respective side supports (30; 31; 321).

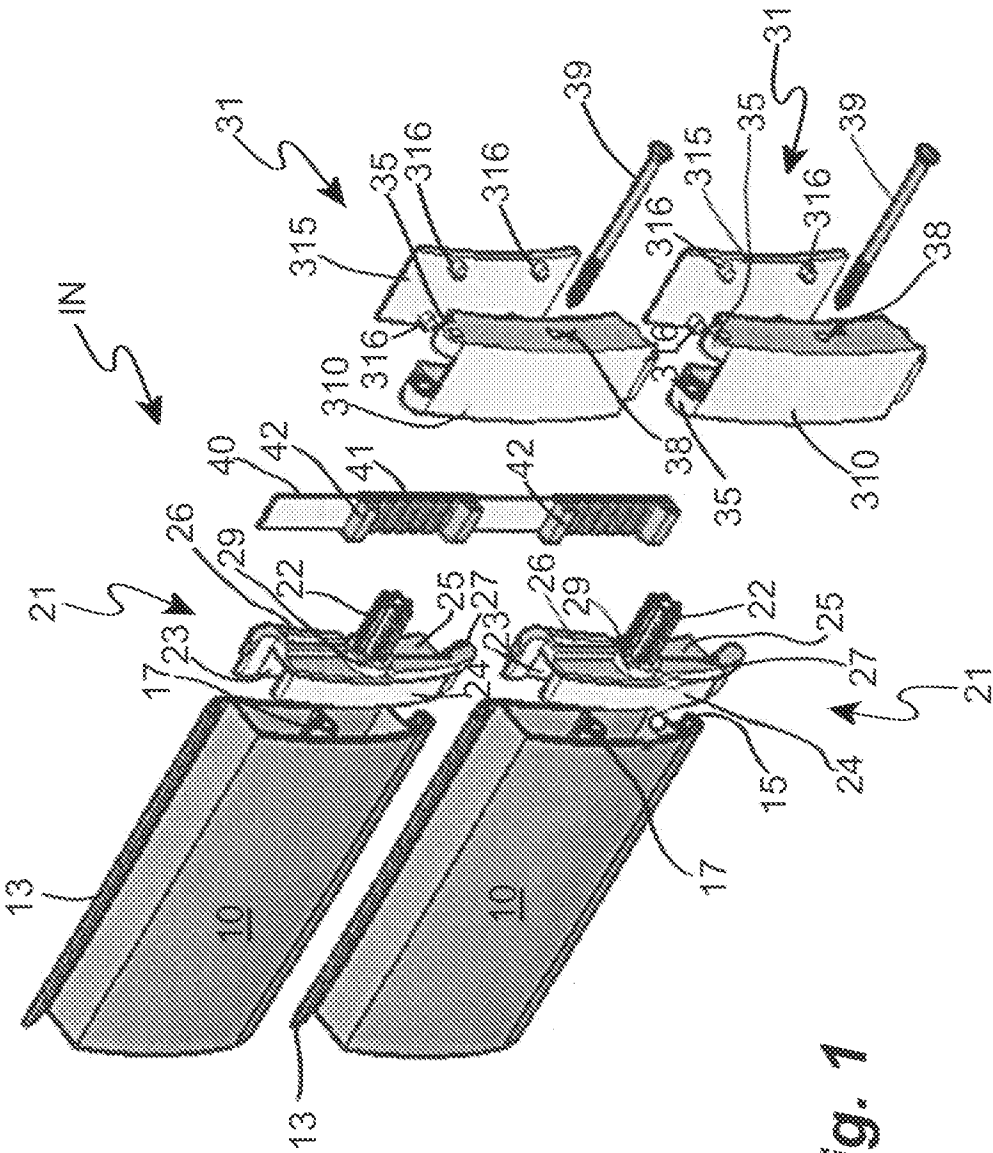
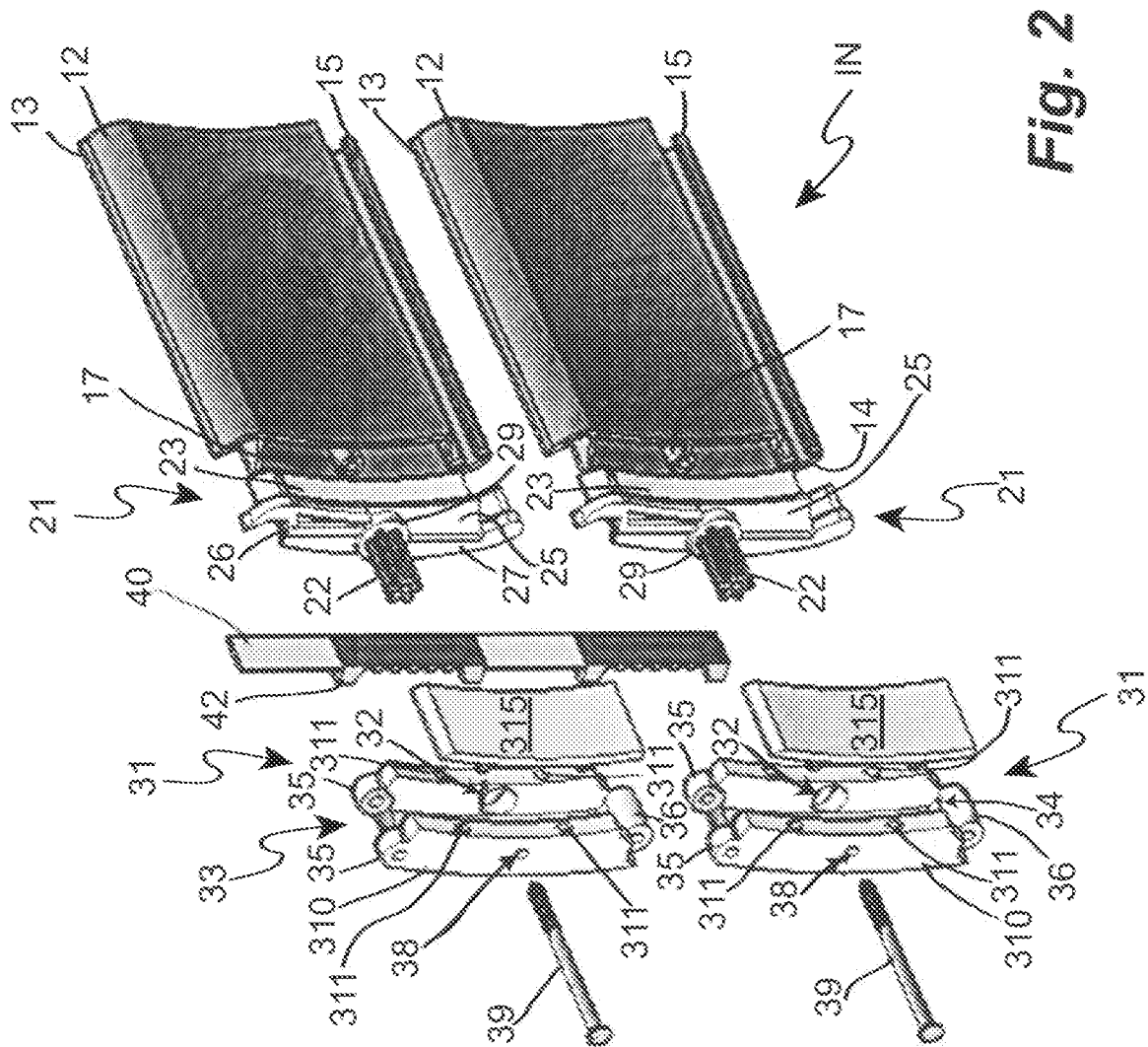
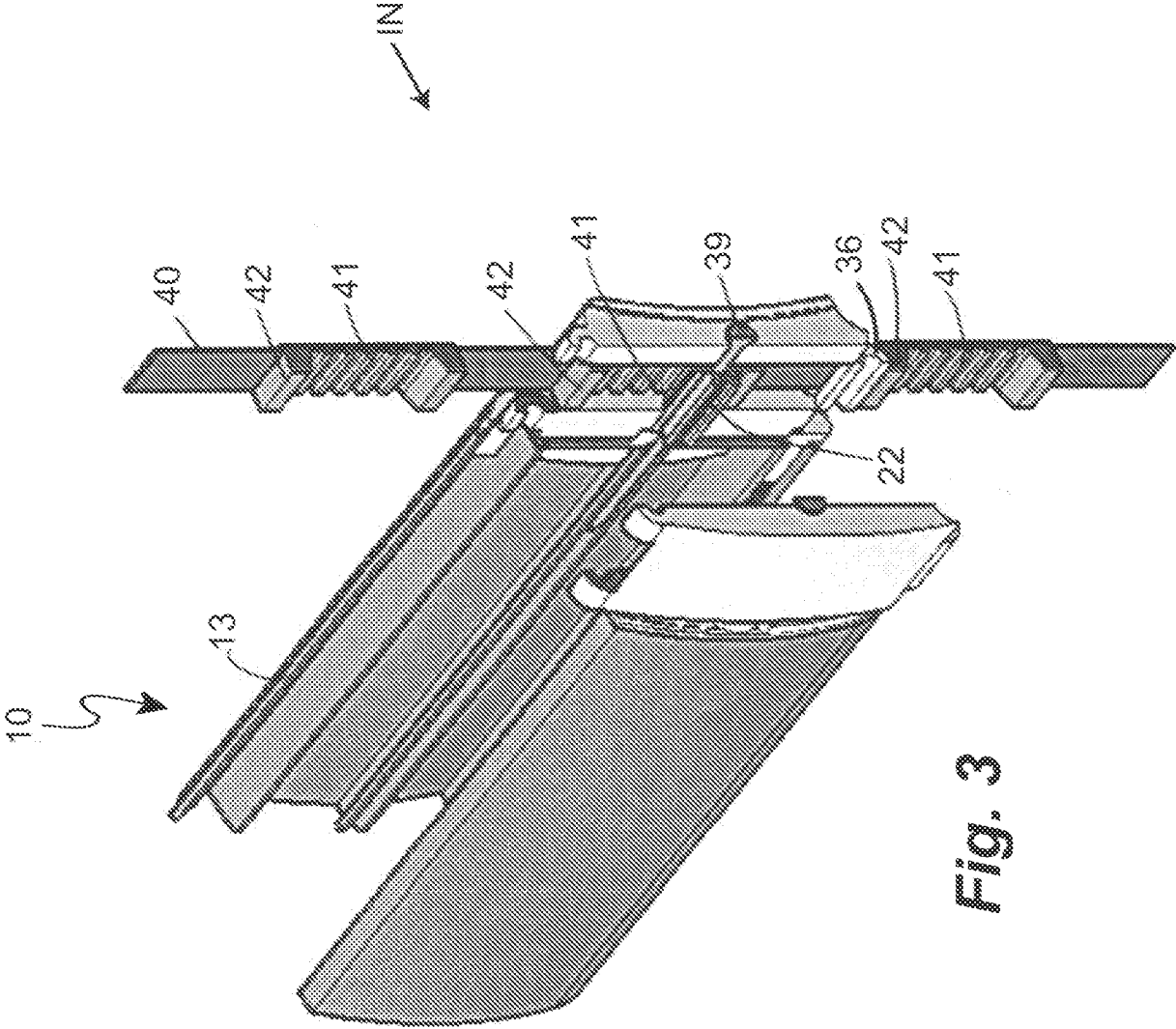
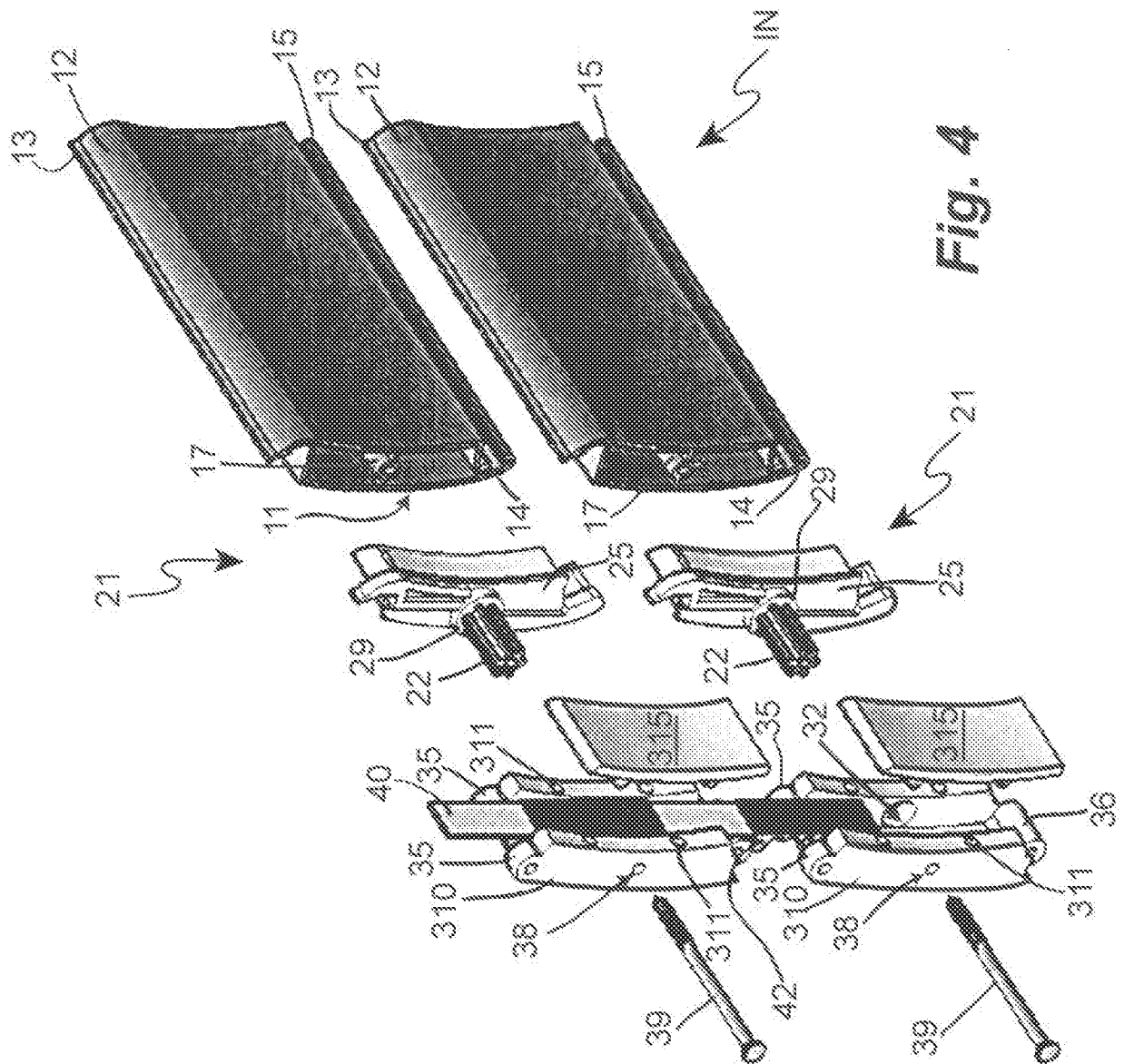


Fig. 1

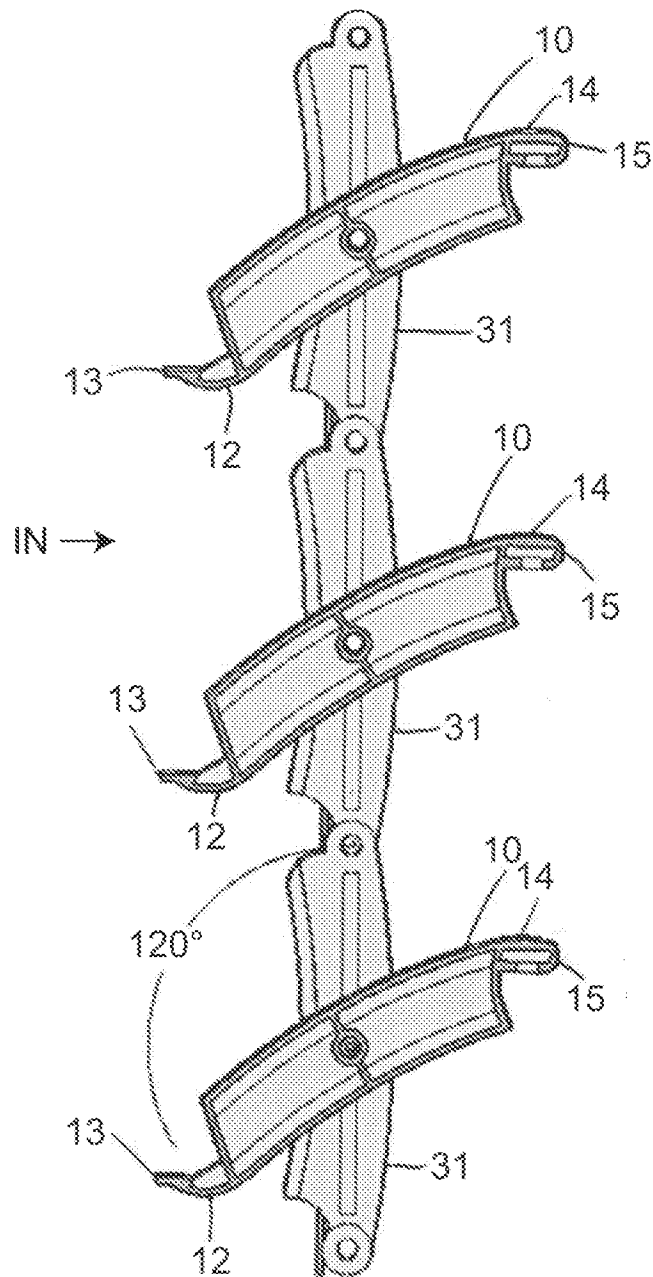




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**Fig. 5**

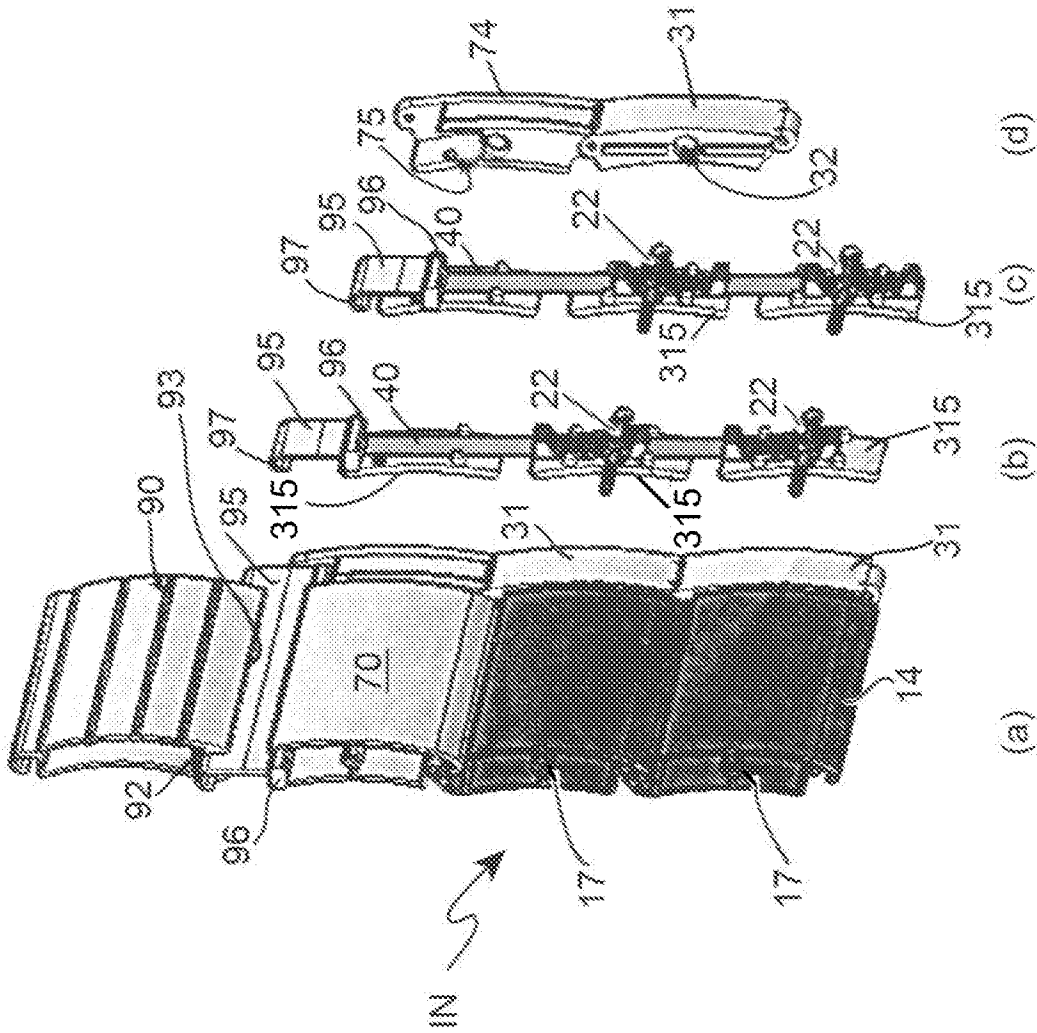


Fig. 6

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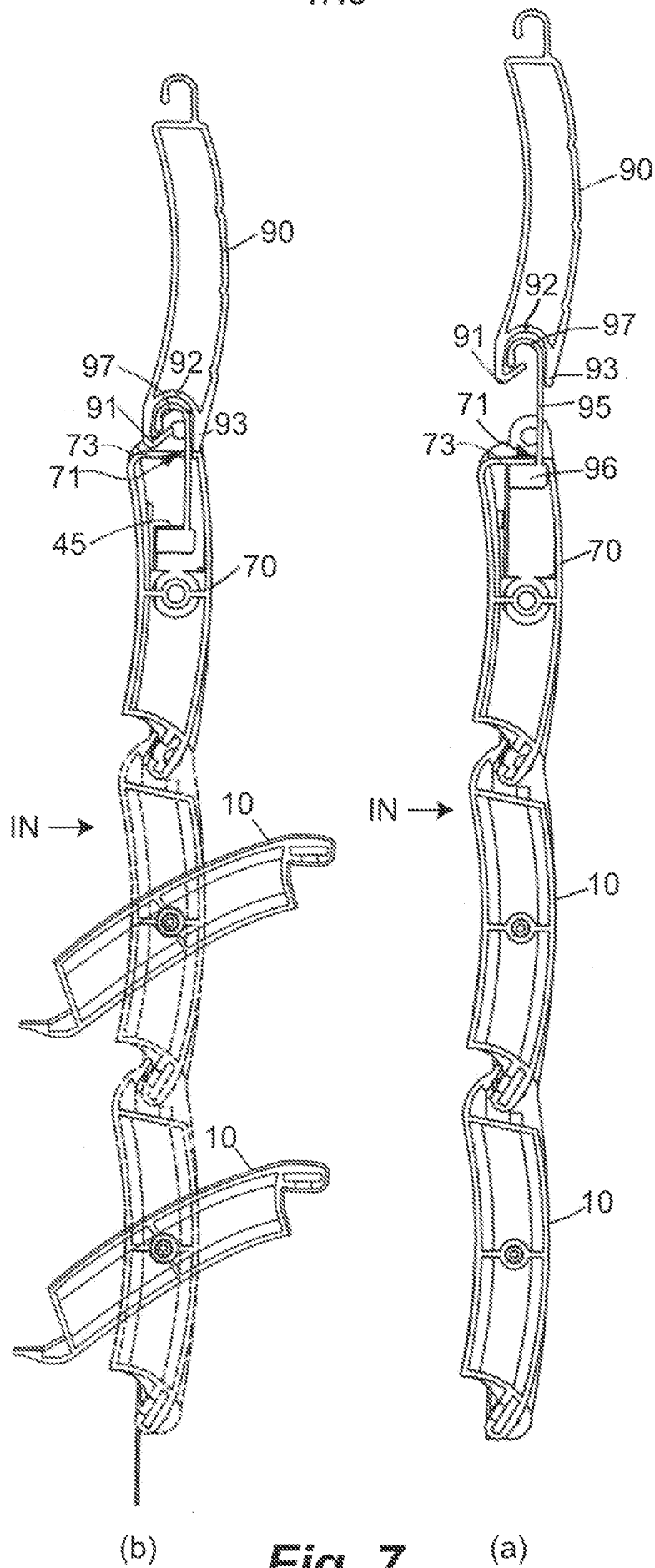


Fig. 7

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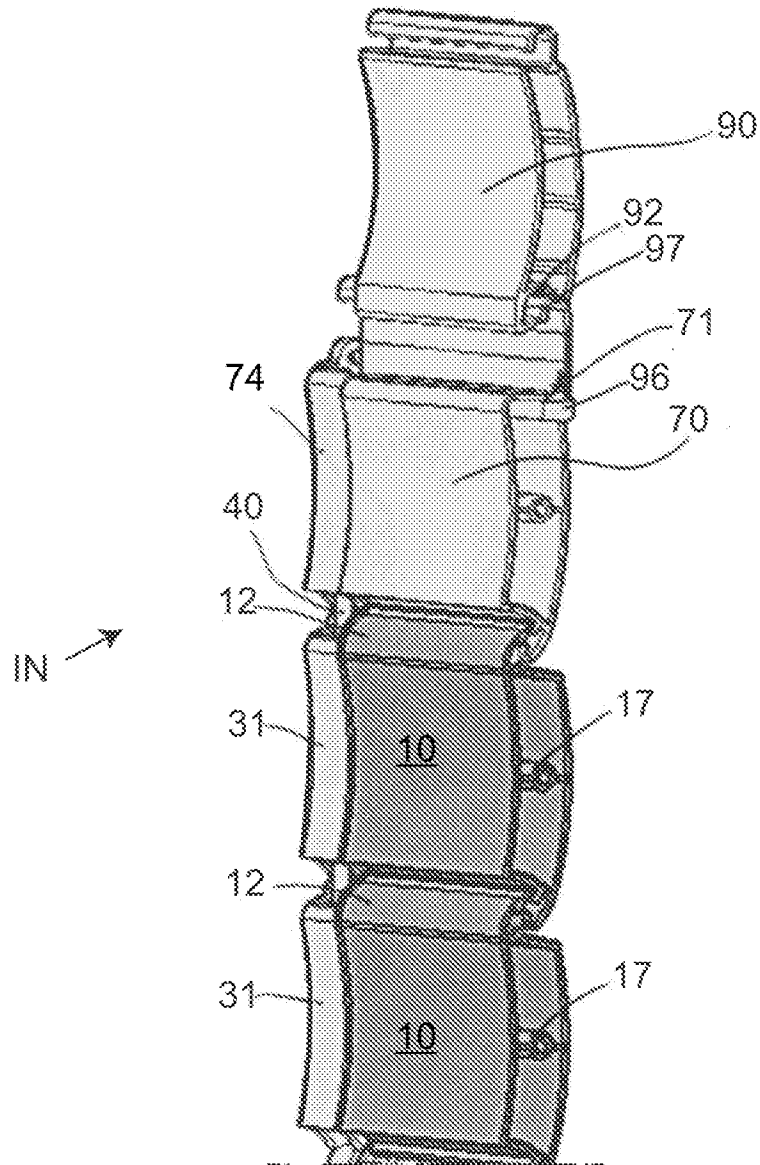
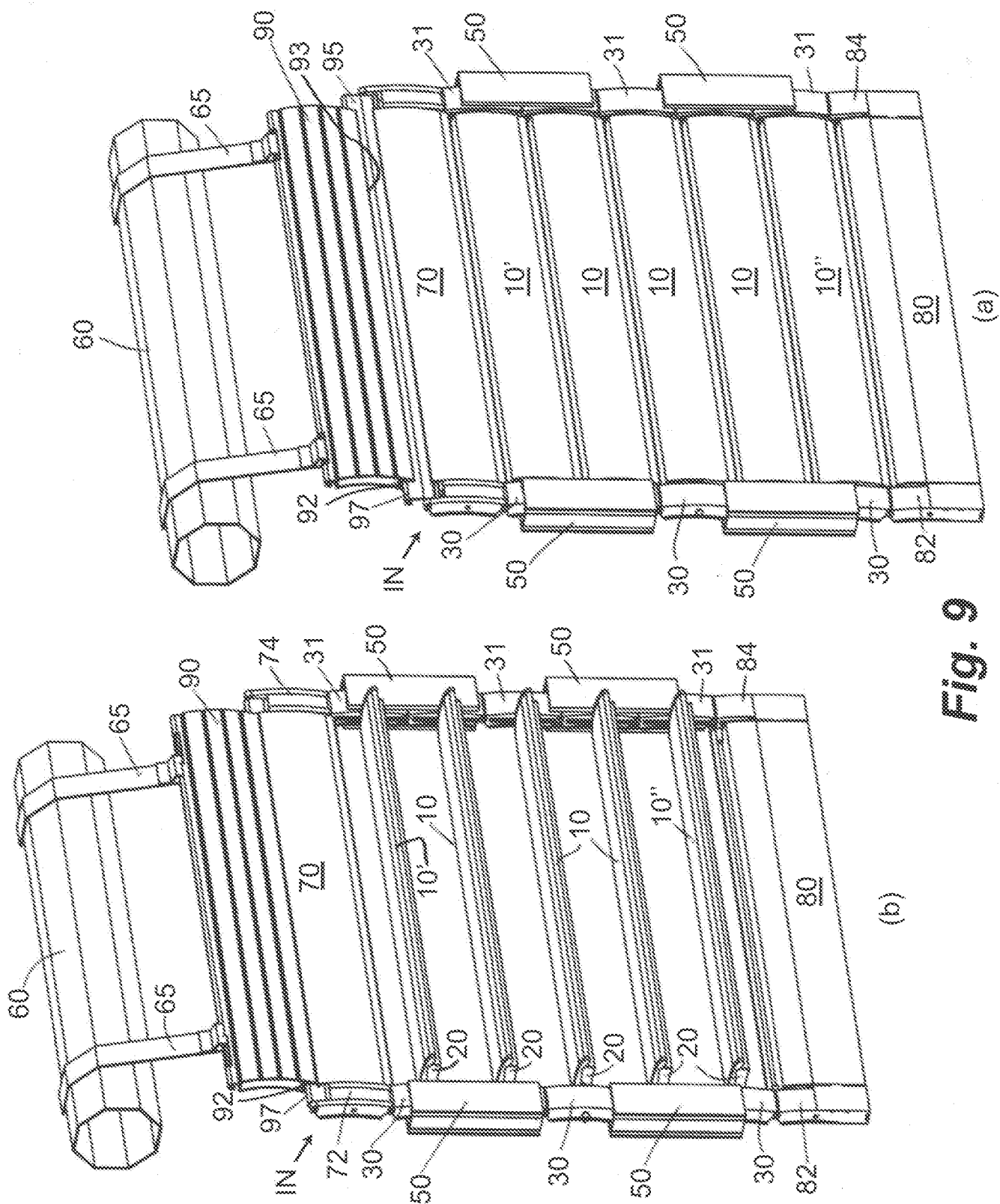


Fig. 8



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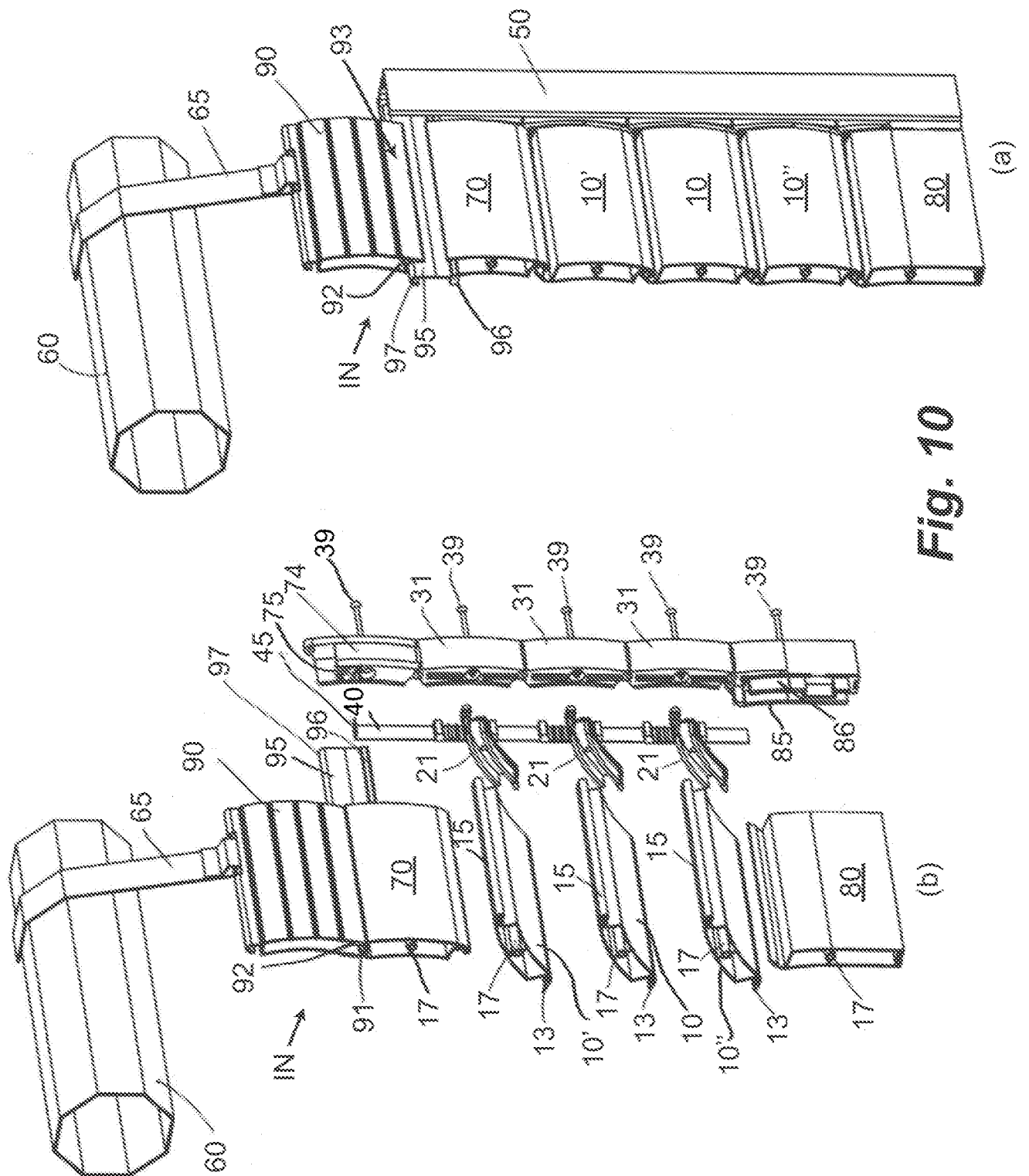
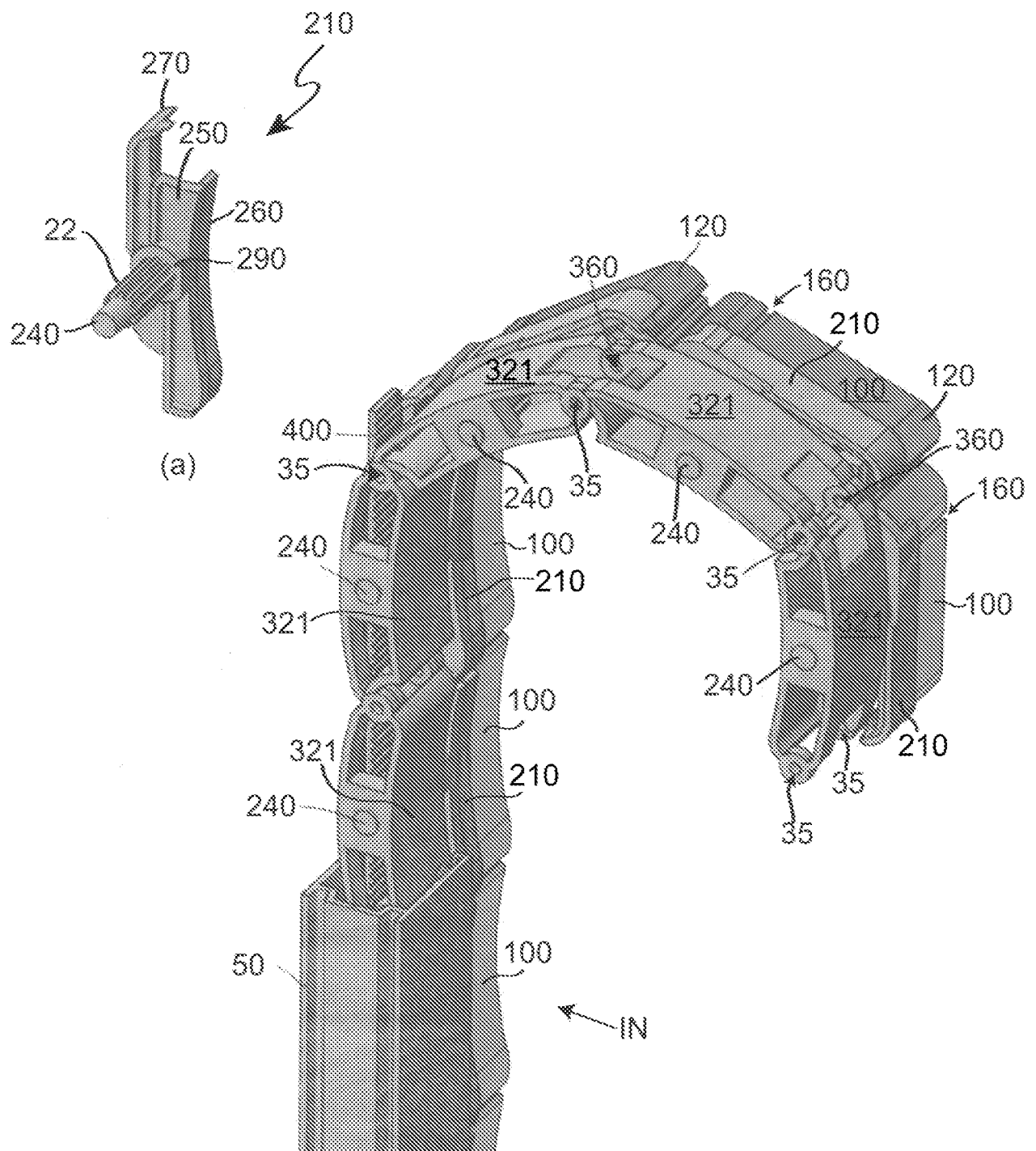


Fig. 10

**Fig. 11**

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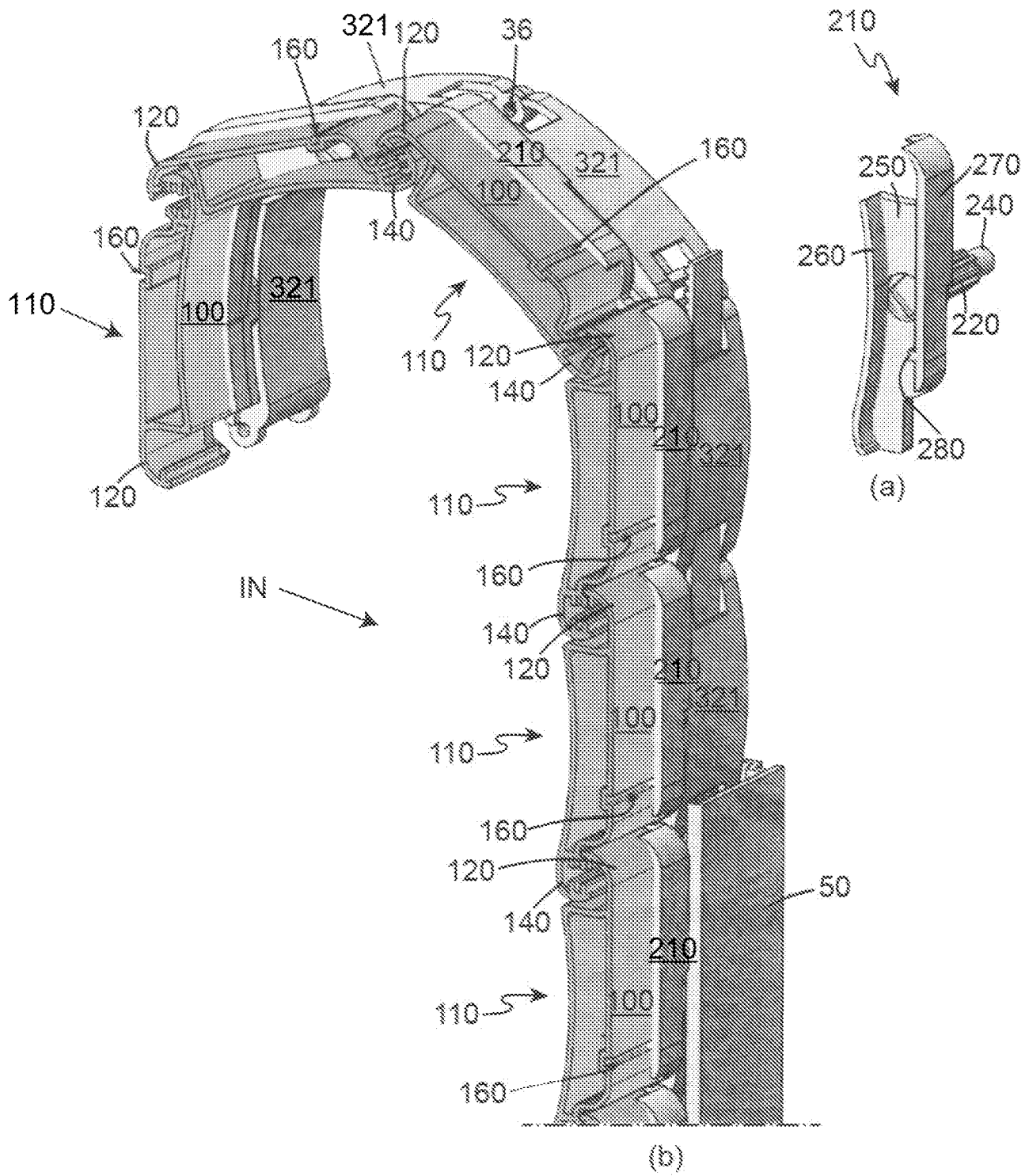
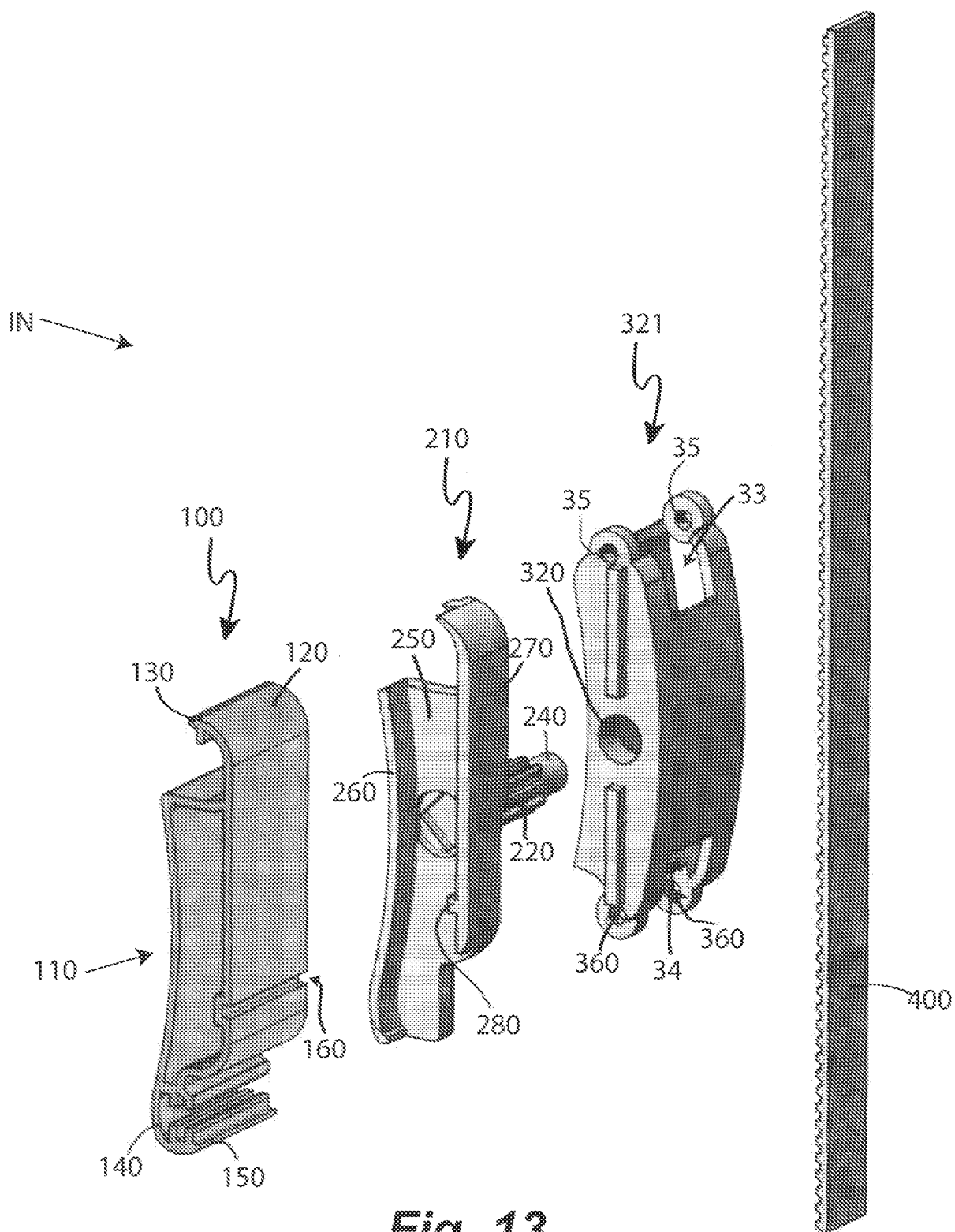


Fig. 12



INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/051063

A. CLASSIFICATION OF SUBJECT MATTER
INV. E06B9/34
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E06B

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

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

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2012/065917 A1 (LUXE PERFIL S L [ES]; MENGUAL MENGUAL JOAQUIN [ES]) 24 May 2012 (2012-05-24) figures 1-4,7	1-15
A	----- WO 2009/143842 A1 (VKR HOLDING AS [DK]; EBBESSEN HENNING [DK]; ULRIKSEN ULRIK [DK]) 3 December 2009 (2009-12-03) cited in the application figures 5,7-10,15-17	1-15
A	----- EP 2 722 475 A1 (TEKNALSYSTEM S R L [IT]) 23 April 2014 (2014-04-23) cited in the application figures 1-5,12	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

24 October 2017

Date of mailing of the international search report

21/11/2017

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Authorized officer

Merz, Wolfgang

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2017/051063

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