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(54) **Opening grating**

(57) A folding grating (10) comprised of a pair of fixed horizontal guides (11) for securing to door or window openings, a set of vertical uprights (13) with ends (13a, 13b) sustained slidably in the guides (11) and moving in parallel. Smooth mechanisms (14) comprised of two rod-shaped elements (15, 16) that are joined to one another, are placed between pairs of adjacent uprights (13). The elements (15, 16) are joined together at an intermediate pivot point (15c) on one single element (15, 16). The first element (15) has an end (15a) mounted pivotably to a fixed pin (17) on a first upright (13') and one end (15b) retained and guided by a second upright (13''), which is adjacent to the first (13'). The second element (16) has one end (16a) mounted pivotably to a fixed pin (18) on a second upright (13'') and the other end (16b) mounted pivotably in point (15c) of the intermediate pivot point of the first element (15).

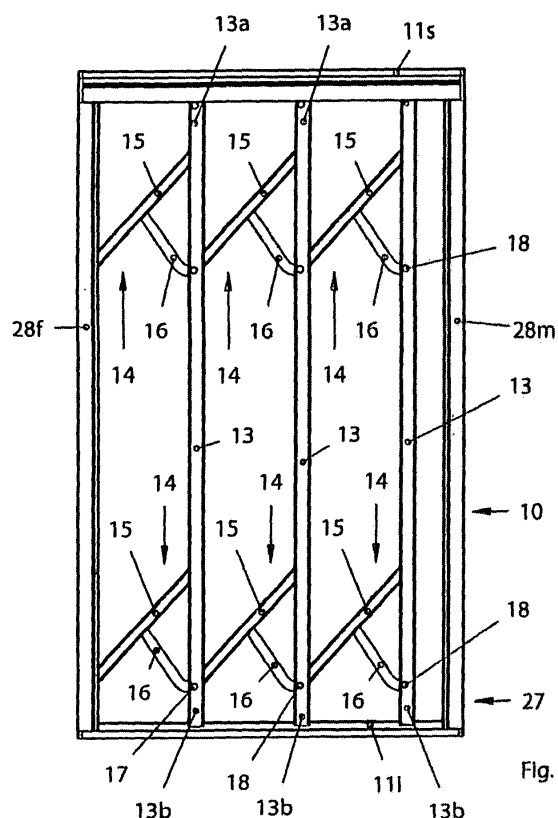


Fig. 1

Description

[0001] This invention refers to construction technology for gratings offering protection against breaking and entry fitted to doors and/or windows in buildings for civil use, such as houses, shops, etc. More specifically, this invention concerns a grating that can be opened and closed as required.

[0002] Industry technology already uses gratings that can be set in two positions. In the first operating position, the grating prevents access by strangers through doorways and/or windows; in the second, on the other hand, the grating, which is folded back against a door and/or window jamb - generally in concertina form - leave the doorway or window easily accessible.

[0003] More specifically, these gratings have vertical uprights, the heights of which correspond to the height of the door or window opening. The ends of each upright are sustained inside two horizontal guides, fitted above and below the uprights respectively, by carriage supports that move along the guides.

[0004] The uprights are connected to one another in pairs, by rod-shaped elements which are secured to the uprights in such a way as to allow them to be pushed together when the grating is folded away and also to connect the uprights solidly together, allowing them to form a strong, solid grille against breaking and entry when opened out.

[0005] To allow the uprights to pass from the fully extended to the fully compacted position, one end of each rod is connected to the upright by hinge and the other end is linked to an adjacent upright so as to remain engaged there, but free to move along the length of the upright itself; thus the angle of the rod can vary from vertical, according whether the distance between two adjacent uprights is being increased or reduced as the grating moves from fully extended to fully compacted.

[0006] To ensure that the uprights remain parallel, especially when the grating is moving from fully extended to folded away - this parallel configuration is necessary for smooth upright movement without jamming caused by uprights that are slanted rather than totally vertical - it is usual to arrange and restrain the rods in the uprights so that they can form jointed parallelograms or in other words, mechanisms that are able to allow the uprights to move closer or further away, while maintaining a constant equidistance between them.

[0007] According to a known technique, it is the uprights themselves that take part in forming a parallelogram mechanism and, more specifically, they form the part of the parallelogram that can be moved against the fixed element of the mechanism.

[0008] In the jointed parallelogram structure - in correspondence to the rotation, against an initial upright (which forms the fixed element of the parallelogram), of two parallel rods, hinged to the upright - to move the second upright up to or away from the first, it is necessary to allow the relevant, contextual movement of the second

upright with respect to the first, in parallel with its own axis line. Since the grating uprights are all obliged to remain engaged in their top and bottom horizontal guides and do not have any evident possibility to move closer to or away from them, to solve this problem, the techniques in use offer different construction solutions that allow the jointed four-sided mechanism to operate as required for the specific purpose.

[0009] An initial solution, described in document US 4006768, foresees a grating structure where the uprights are devised so as to present two distinct components fitted coaxially in a guide, one on the other, so as to be able to move lengthways to the upright as required by the characteristic kinematics of the jointed parallelogram mechanism.

[0010] A second technique in use, similar to the previous one, foresees fitting a sliding block inside the upright that is opposite the actuating upright of the fixed element of the parallelogram. The sliding block can slide along and inside the upright is connected to the ends of the rotating rods of the jointed parallelogram.

[0011] The rigidity of the grating surface in current solutions is mainly entrusted to the geometric and resistance characteristics of the uprights.

[0012] Resistance to breaking and entry, on the other hand, is prevalently entrusted to the rods connecting the uprights. In fact, in view of their linear structure and intrinsic flat metal construction, the rods placed between the uprights contribute to a lesser extent to the non-deformability and rigidity of the grating, both in terms of stresses from the outside and directed perpendicularly to surface of the grating as well as the tangential stresses to the support surface of the grate.

[0013] As a result, when opening windows and/or doors of notable height - also due to the inevitable construction clearance found on the hinge pins - to withstand the coupling of slanting component parts, which would obstruct the regular sliding movement of the uprights, it is necessary to place a relatively high number of connecting rods between each pair of uprights, with evident complications in terms of manufacturing and costs.

[0014] In terms of fundamental security against breaking and entry, the rods, which are normally made in flat steel or in another type of metal, but not hollow, are problematic in that they can be cut with relative ease. Therefore, breaking and entry prevention is based more on the number of rods than on their resistance to shearing. In fact, it is clear that once the rods connecting two adjacent uprights have been cut, it is easy to open a grating in full.

[0015] Another technique in use foresees the connection of uprights in pairs, using mechanisms consisting of two cross-pieces that form an X, centrally hinged to one another and with one end hinged to one upright and the other slidably engaged to the other.

[0016] This mechanism, which offers the fundamental advantage of allowing the uprights always to move parallel to one another, also involves a series of noteworthy problems. In fact, due to its intrinsic construction, the

hinge connecting the rods remains clearly visible to anyone looking at the grating. This means that it is possible to tamper with the upright connections with relative ease, removing the pin - with a drill, for example - before cutting the rods at the hinged points, which form the area of lowest rod resistance due to the presence of the hole for the pin to pass through.

[0017] Other problems with this type of grating can be found in the fact that, due to the prominence of the joint pin heads, it is quite frequent for hands to become injured when the grating is being cleaned and/or serviced.

[0018] Another problem lies in the fact that it is easier for a greater intensity of grating corrosion to be triggered at the joint mechanism and pin points, between the relevant rods. As a result, problems arise with maintenance and/or the appearance of the grating once it has been damaged by corrosion.

[0019] The main technical aim of this invention is to supply a folding grating of the type comprised of mechanisms that use jointed rods placed between uprights from which they remain independent; it must be devised in such a way as to offer a particularly high degree of resistance to breaking and entry in the connection points of adjacent uprights, so as to make it difficult to remove the connections between the grating uprights themselves.

[0020] A further purpose of this invention is to supply connections between uprights devised to contribute significantly to the overall rigidity of the grating, both at a tangent to the support surface and perpendicular to said surface; this is to contribute to resistance to breaking and entry and to the regular sliding motion of the uprights when the grating is opened out or folded away.

[0021] Another purpose of this invention is to offer a grating with great strength and rigidity both on the uprights and on the horizontal guides along which the upright ends travel.

[0022] In accordance with the aforementioned purposes, the invention has technical characteristics that can be easily deduced by the claims stated hereinafter and in particular, in claim 1 and furthermore, in any other claim that is directly or indirectly dependent on claim 1.

[0023] The advantages of this invention will become even clearer from the detailed description that follows, referring to the annexed drawings that show purely indicative and in no way limiting embodiments of the invention in which:

- Figure 1 shows an overall view, in elevation, of the grating, according to the invention;
- Figure 2 shows a partial perspective view of the grating in Figure 1, shown with some parts removed in order to highlight others;
- Figure 3 shows a detail of Figure 2, represented on a larger scale;
- Figure 4 shows an exploded perspective view of a detail of the grating;
- Figure 5 shows a cross-section view of a detail of

the grating uprights;

- Figure 6 shows an exploded view of a particular form of execution of the joint pins on the grating;
- Figure 7 shows a partial perspective view of a detail of the grating uprights;
- Figure 8 shows a cross-section of the detail in Figure 7;
- Figure 9 shows a perspective view illustrating one end of the uprights;
- Figure 10 shows a perspective view illustrating the other end of the uprights;
- Figure 11 shows a perspective view illustrating a construction detail of the uprights at the end of the grating, according to the invention;
- Figures 12 and 13 show sections of the horizontal guides, top and bottom respectively, of the grating.

[0024] With reference to the figures of the annexed drawings, Figures 1 and 2 illustrate a folding grating that is essentially comprised of a flat metal rectangular frame 27 to be fitted to the edges of a door or window opening (not shown) and complete with a pair of horizontal guides, one at the bottom 11i and one at the top 11s, as well as a pair of vertical uprights 28, connected to the ends of the guides 11s and 11i. One of the perimeter uprights 28f of the frame 27 is fixed and an integral part of the wall structure of the opening, while the other 28m has a handle and lock (not illustrated) to open and close the grating 10.

[0025] The grating 10 also has a number of mobile vertical uprights 13 with opposite ends 13a and 13b slidably disposed in the horizontal guides 11s and 11i of the frame 27 to allow the uprights 13 to move in a parallel manner along the fixed guides 11s and 11i of the frame 27.

[0026] The grating 10 also includes (Figure 2) smooth mechanisms 14 with two rigid jointed elements, positioned between the uprights 13 and preferably at two different heights on the grating 10.

[0027] More specifically (Figure 3), each smooth mechanism 14 piano is fitted with two rod-shaped elements 15 and 16, joined together at an intermediate pivot point 15c of just one 15 of them, and it is placed between adjacent pairs of uprights 13.

[0028] An initial rod-shaped element 15 of the smooth mechanism 14 has one end 15a mounted pivotably to a pin 17 fixed to the first upright 13', and the other end 15b retained and guided by a second upright 13'', which is adjacent to the first 13'.

[0029] The second rod-shaped element 16 has one end 16a mounted pivotably to a pin 18 fixed on the second upright 13'' and an opposite end 16b mounted pivotably in point 15c of the intermediate pivot of the first rod-shaped element 15, which, for this purpose, has been fitted with seating 32 for a pin 30 which, during the evolution of the mechanism 14, moves on the support surface of the mechanism 14 itself.

[0030] The mechanism 14 is preferably made in steel.

Moreover, as can be seen in Figure 4, the mechanism 14 foresees that the first rod-shaped element 15 presents a thin-walled cross section with open profile, preferably U-shaped.

[0031] Inside the U-shaped profile, the rod-shaped element 15 houses, two plates 33 holding the seats 32 to support the pin 30 that connects the second rod-shaped element 16 to the first 15.

[0032] The assembled structure of the element 15 described above is particularly advantageous for a variety of reasons.

[0033] In the first place, the choice of steel material and in particular for the U-shaped profile means a high degree of shearing strength in the very areas where adjacent uprights 13 are connected. This is where standard types of grating have a lesser degree of resistance to break-ins through the opening in the building protected by the grating 10.

[0034] In the second place, the open form of the U-shaped, thin-walled profile edging makes it increasingly difficult to cut, as the blade proceeds through its section. In fact, cutting an open form causes the section to bend, warping in such a way as to obstruct blade movement and at times even offering enough resistance to snap it. Of course, this works in favour of the break-in resistance of the grating 10.

[0035] A further advantage of the U shape is clearly seen when comparing Figure 3 and Figure 1; it is the fact that the joint is concealed between the rod-shaped elements 15 and 16, relevant to the intermediate pivot point 15c of the first rod-shaped element 15. This concealment makes it difficult to identify the exact position of the pin 30 on the joint, meaning its location is uncertain and difficult to reach, for example, when using a drill to attempt to break the connection between the rod-shaped elements 15 and 16.

[0036] Another important aspect, in terms of the resistance to break-ins offered by the mechanism 14, can be seen in the fact that, on account of the special way that the rod-shaped elements 15 and 16 of the mechanism 14 have been structured, said rod-shaped elements 15 and 16 have no weak points caused by the presence of a localised section that offers lower resistance to shearing.

[0037] More specifically, the mechanism 14 has a three-sided structure comprised of the two aforementioned rod-shaped elements 15 and 16, connected to an upright 13" so as to form a flat substantially isosceles triangle. In particular, in Figure 3 it is possible to see that the rod-shaped element 15 is substantially twice as long as the other 16.

[0038] Each mechanism 14 serves to restrain the uprights 13' and 13" keeping them strictly level and allowing the relevant approach and/or retracting movement of the uprights 13 along the support surface of the grating 10 in conditions where the uprights 13 remain substantially equidistant from one another.

[0039] Figure 7 shows that the grating 10 also has fixed

guides 44, located inside each second upright 13" to which the second end 15b of the first rod-shaped element 15 of each mechanism 24 is slidably mounted.

[0040] The guides 44 also have stops 48 and 49 to limit the travel of the second end 15b of the first rod-shaped element 15 on the guide 49.

[0041] At least one of the limit stops 49 offers the possibility to adjust its position with respect to the guide 44.

[0042] The grating 10 will preferably include bars 51 to incorporate the guide 44 and also have a seat 50 for a corresponding fixed pin 17 for the second rod-shaped element 16.

The guide 44 or in other words, the bar 51 incorporating it, is made in antifriction material, preferably plastic.

[0043] The use of a bar 51 in antifriction material is particularly advantageous for allowing the pin 31 at the second end 15b of the first rod-shaped element 15 to move along the guide 44 (also see Figure 8) with the minimum friction, minimum clearance and silent operation. Operation is equally smooth for the pins 17 or 18 of the mechanism 24 joined to the same bar 51, or in other words, to the same upright 13".

[0044] The plastic nature of the anti-friction material guarantees durability and of course, needs no lubrication as well as allowing the grating 10 to be washed with water alone to remove any dust build up.

[0045] Figures 2 and 3 also show that each of the smooth mechanisms 14 fitted vertically to connect a couple of the aforementioned uprights 13' and 13", can be integrated, with advantages, with motion transmission mechanisms 20 that allow the coordinated movement of the same sets of rod-shaped elements 15 and 16 forming the smooth mechanisms 14 mounted one above the other on the vertical part of the grating 10 and needed for the relevant movement of a same pair of uprights 13' and 13".

[0046] These coordinated transmission mechanisms 20 include a jointed parallelogram mechanism, which has been completely housed inside an upright 13'.

[0047] The jointed parallelogram mechanism 20 includes, in particular (Figure 3) two rocker arms 21, which oscillate at an angle around fixed hinged pins 17, supported by a same upright 13' and a connecting rod 22 linking said rocker arms 21 and housed inside the same upright 13' to which the rocker arms are hinged 21.

[0048] Each rocker arm 21 is rigidly mounted pivotably to the first rod-shaped element 15 of each of the mechanisms 14 mounted one above the other on the vertical part of the grating 10, and it allows mechanically coordinated rotation of the first rod-shaped elements 15, which are thus kept constantly parallel with one another.

[0049] The rocker arms 21 will preferably have a circular segmented layout, where the toothed segments 23 rotate integrally with the first rod-shaped elements 15 of the mechanisms 14. The connecting rod 22 also includes a rack 24 to mesh with the sectors 23 in correspondence to one or more teeth.

[0050] At this point it is understandable that each

smooth mechanism 14 fitted between pairs of adjacent uprights 13' and 13" makes it possible to keep the uprights 13' and 13" strictly level with one another. Moreover, the mechanisms 14 for a same pair of uprights 13' and 13", which are placed vertically one over the other, are able to perform the approach and/or retraction movement for the uprights 13 along the support surface of the grating 10, due to the effects of the coordinated, synchronous movement of the mechanism 20, and they do so keeping the same distance between the uprights 13' and 13".

[0051] The parallel motion of the uprights 13 is achieved with a number of surplus constraints which, together with the three-sided form of the smooth mechanisms 14, give the grating 10 a high degree of rigidity on its support surface and a rather smooth sliding movement that can be obtained through a minimum manual pushing or pulling action.

[0052] Figures 5 and 8 show in particular that, for the purpose of increasing overall rigidity for the grating 10 on one hand and resistance to breaking and entry on the other, the uprights 13 of the grating 10 can be created - with benefits - using a C-shaped sheet profile with flanges 34 at the tops and ends of the profile with localised stiffeners 35 obtained by making permanent deformations with strong local curvatures in the profile.

[0053] This configuration of the C-shaped profile offers the advantage of requiring a high number of cuts before being able to cut through the upright and tamper with the grating 10. Cutting steel elements bent with permanent deformation is also made more difficult by local bench-hardening phenomena on the material, which increase the grating's ability to withstand breaking and entry.

[0054] The C-shaped configuration defined here above also makes it possible to create rigid, highly non-deformable seats 36 inside the upright 13 and inside these seats, the guides 44 of pin 31 can be housed and immovably constrained when attempts are made to access them through the opening of the C-shaped profile.

[0055] Figure 6 illustrates an internal expansion rivet 37 that can be advantageously used to create (Figure 7) the fixed pins 17 and 18 to be hinged to the uprights 13 of the rod-shaped elements 15 and 16.

[0056] This type of rivet 37 is particularly advantageous since it requires less effort to be installed and at the same time it is rather difficult to disassemble, since it requires total removal of its head 38.

[0057] Figures 7 and 8 also show how the uprights 13 can beneficially include half covering shells 39 with elongated forms to conceal the pins 17 and 18 connecting the uprights 13 and rod-shaped elements 15 and 16, pivotably mounting them to one another.

[0058] These half shells 39 offer numerous advantages. In the first place, their presence prevents the exact position of the pins 17 and 18 to be identified, making it rather difficult to tamper with the grating 10. Secondly, the aforementioned half shells 39, if made in metal that can withstand atmospheric corrosion (such as, for exam-

ple, aluminium alloys) offer protection against corrosion and the action of the elements and dust on the joints of the grating 10 with regard to the uprights 13.

[0059] The half shells 39 also offer the additional advantage of giving the grating 10 a stylish appearance, independently of the security against breaking and entry, which is in any case guaranteed by the C-shaped profiles of the uprights 13.

[0060] The half shells 39 can also be made, if required, using a material less resistant to break-ins, such as wood or plastic, or in any other material for aesthetic purposes only.

[0061] As far as the security aspect of the grating 10 is concerned, Figures 7 and 8 clearly show that the half shells 39 can be associated to the C-shaped profiles of the uprights 13 through guide grooves 40 around the swells 47 of the tops and free ends of the flanges 34 on the C-shaped profile. The half shells can also be engaged permanently with said profile, with a relative longitudinal movement at the uprights 13. Since the uprights 13 will engage with the horizontal guides 11s and 11i at the top and bottom of the grating 10, the removal of the half shells 39 from the C-shaped profiles becomes difficult on account of the guides 11s and 11i, which block their ends.

[0062] Figures 12 and 13 illustrate in particular, the cross sections of the aforementioned guides 11s and 11i, showing that in a cavity 45 of the first guide, it is possible to insert (Figures 9 and 11) carriage supports 41 from the top ends 13a of the uprights 13, and that it is possible to engage the bottom ends 13b of the upright 13 in the second guide 11i, complete with a suitable gap in the material 42 destined to delineate a prominent track 46 of the bottom guide 11i. The aforementioned Figures 12 and 13 show, more specifically, that it is possible to fit steel bars 43 inside the profiles constituting the guides 11s and 11i to armour them from the inside and therefore prevent the grating 10 from being cut and as a result, tampered with.

[0063] The invention as conceived is open to obvious industrial applications and it can also be subjected to numerous changes and variations, all of which are part of the invention's concept; all details can be replaced by technically equivalent elements.

Claims

1. Folding grating of the type including a pair of fixed horizontal guides (11) for securing to a door or window opening; a group of vertical uprights (13), the opposite ends (13a, 13b) of which are slidably mounted in the horizontal guides (11), which move in parallel to one another along the fixed guides (11); at least one smooth mechanism (14), having two rod-shaped elements (15, 16) hinged one another, and placed between pairs of adjacent uprights (13); said rod-shaped elements (15, 16) are hinged one another at an intermediate pivot point (15c) on just one of

- said elements (15, 16); the first rod-shaped element (15) of the smooth mechanism (14) having one end (15a) mounted pivotably to a fixed pin (17) on a first upright (13') and a second end (15b) retained and guided by a second upright (13'') adjacent to the first (13'); the second rod-shaped element (16) having one end (16a) mounted pivotably to a fixed pin (18) on the second upright (13'') and an opposite end (16b) mounted pivotably to the intermediate pivot point (15c) of the first rod-shaped element (15), the grating, **characterised in that** it comprises at least one fixed guide (44) located inside the aforementioned second upright (13'') on which the second end (15b) of said first rod-shaped element (15) is slidably disposed.
2. The grating of claim 1, **characterised in that** it comprises stops (48, 49) to limit the travel of the aforementioned second end in the guide (44).
 3. The grating of claim 2, **characterised in that** said stops include at least one limit stop (49) with an adjustable position compared to the guide (44).
 4. The grating of claim 1, **characterised in that** it comprises at least one bar (51) incorporating said guide (44) and containing a seat (50) for a corresponding and aforementioned fixed pin (17) on the second rod-shaped element (16).
 5. The grating of claims 1 or 4, **characterised in that** the aforementioned guide (44) at least is made using anti-friction material.
 6. The grating of claim 1, **characterised in that** the aforementioned intermediate pivot point (15c) is concealed from view.
 7. The grating of claim 1, **characterised in that** one or each mechanism (14) has a three-sided structure including two of said rod-shaped elements (15, 16) connected to the same upright (13'') to form a flat and substantially isosceles triangle, one or each of the aforementioned mechanisms (14) being suitable to constrain the uprights (13', 13'') so as to keep them closely level with it and allow the relevant approach and/or retracting movement of the uprights (13), on the support surface of the grating (10), while maintaining a substantially equal distance between the uprights (13).
 8. The grating of claim 7, **characterised in that** said rod-shaped elements (15, 16) are double the length (15) of the others (16).
 9. The grating of claim 1, **characterised in that** one or each smooth mechanism (14) foresees that at least said first rod-shaped element (15) has thin-walled cross sections and an open profile.
 10. The grating as stated in one of the previous claims, **characterised in that** said thin-walled open profile has a U-shaped cross section.
 11. The grating of claim 1, **characterised in that** at least one or each mechanism (14) is made in steel.
 12. The grating of claim 1, **characterised in that** said rod-shaped elements (15, 16) have pinned hinge joints (30, 17, 18) that are concealed from view.
 13. The grating as stated in one of the previous claims, **characterised in that** it comprises at least two of the aforementioned smooth mechanisms (14) fitted to join a same pair of the aforementioned uprights (13', 13''); and transmission means (20) to connect the series of rod-shaped elements (15, 16) of the aforementioned smooth mechanisms (14) so as to permit coordinated movement.
 14. The grating of claim 13, **characterised in that** said coordinated transmission means include a jointed parallelogram mechanism (20), working with a single upright (13') to which the first series of rod-shaped elements (15) of the aforementioned smooth mechanisms (14).
 15. The grating of claim 13, **characterised in that** said jointed parallelogram mechanism (20) includes two rocker arms (21), oscillating at an angle around fixed hinge pins (17) supported by an upright (13') and a connecting rod (22) between the rocker arms (21) and which is placed inside the riser (13') to which the rocker arms (21) are hinged, each rocker arm (21) being connected in rotation to the first rod-shaped element (15) of each of the aforementioned mechanisms (14) so as to permit the mechanically coordinated rotation of the first rod-shaped elements (15).
 16. The grating of claim 15, **characterised in that** said rocker arms (21) include toothed sectors (23) that rotate integrally with the aforementioned rod-shaped elements (15, 16) and that the aforementioned connecting rod (22) includes a rack (24) to mesh with said sectors (23) with at least one tooth.
 17. The grating of claim 1, **characterised in that** said uprights (13) are comprised of C-shaped profiles with flanges (34) reinforced by localised stiffeners (35).
 18. The grating of claim 1, **characterised in that** the aforementioned uprights (13) include half covering shells (39).
 19. The grating of claim 18, **characterised in that** said

half covering shells (39) can be associated to C-shaped profiles fitted to the aforementioned uprights (13) by guide grooves (40) around the flanges (34) of said C-shaped profiles.

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20. The grating of claim 1, **characterised in that** the aforementioned fixed guides (11) include a guide (11s) and a guide (11i) fitted respectively above and below said uprights (13), with at least one of the aforementioned guides (11) being fitted with at least one bar (43) to armour the structure.

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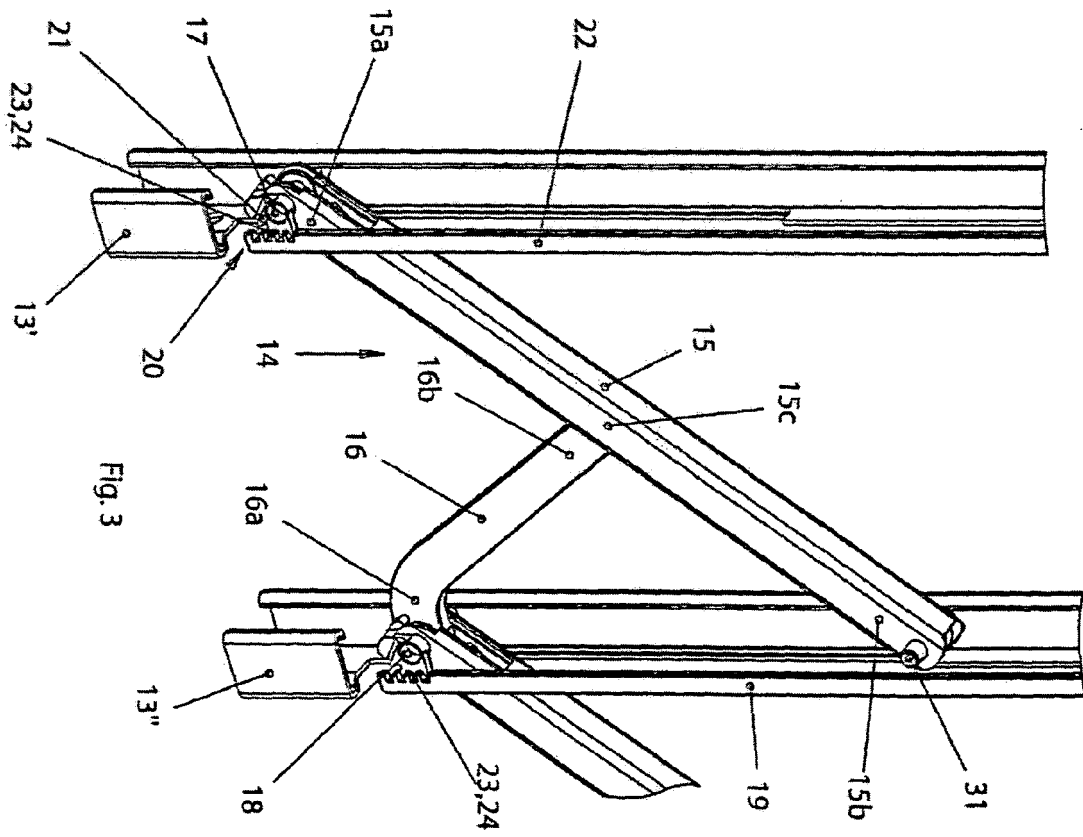
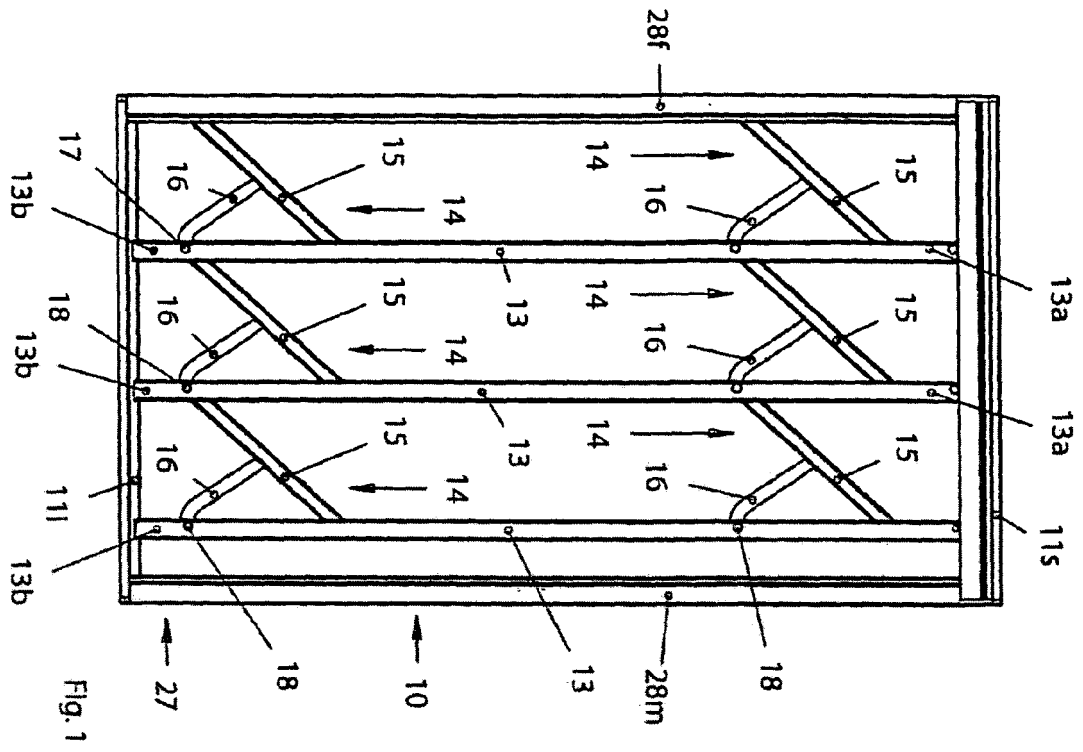
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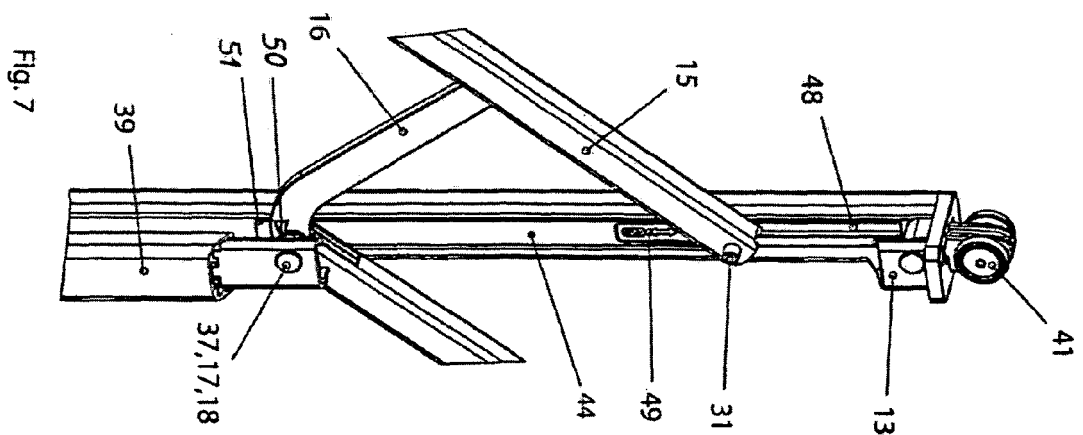
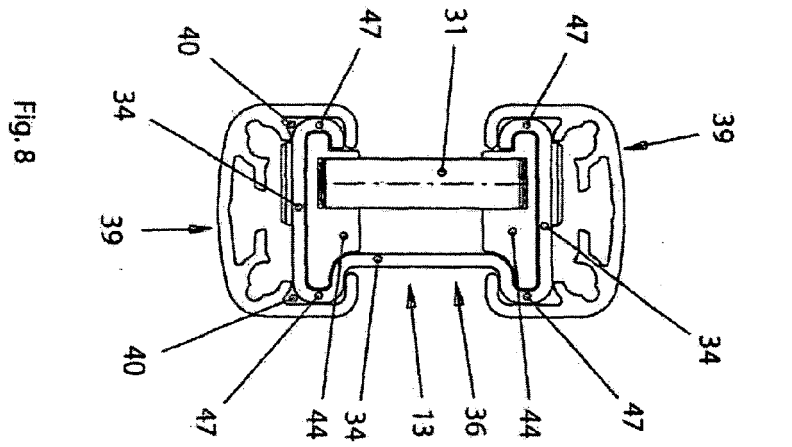
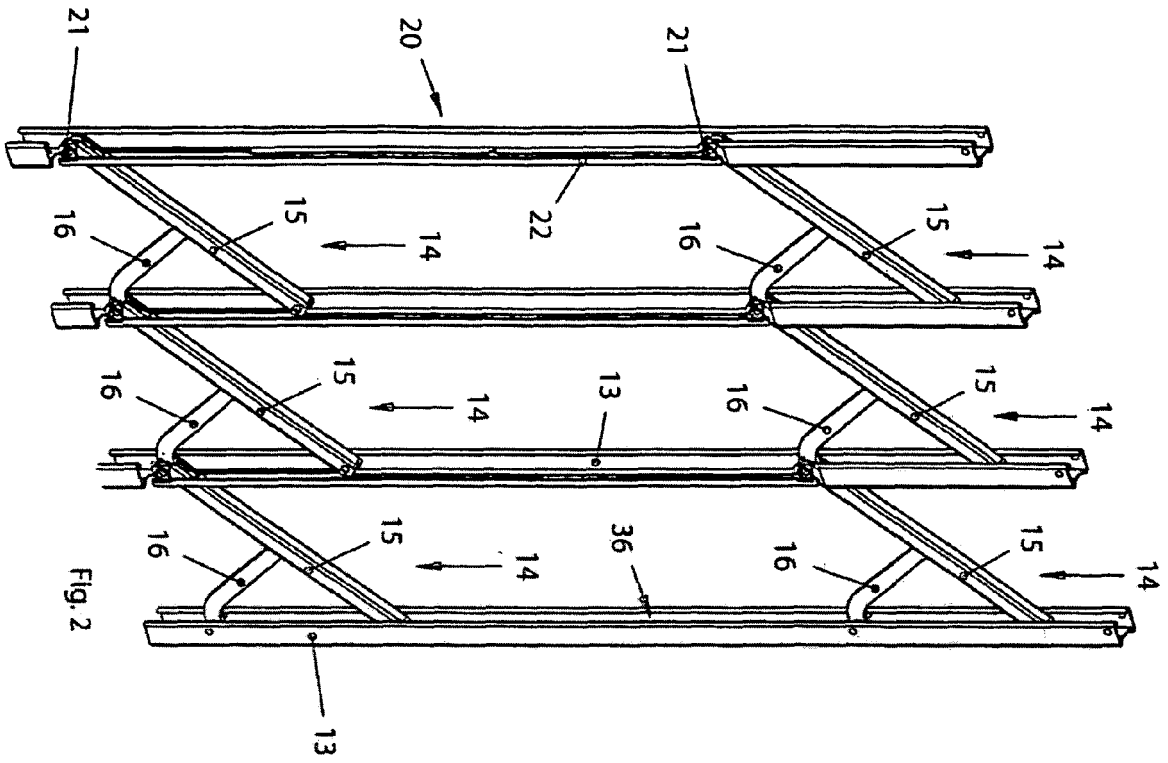
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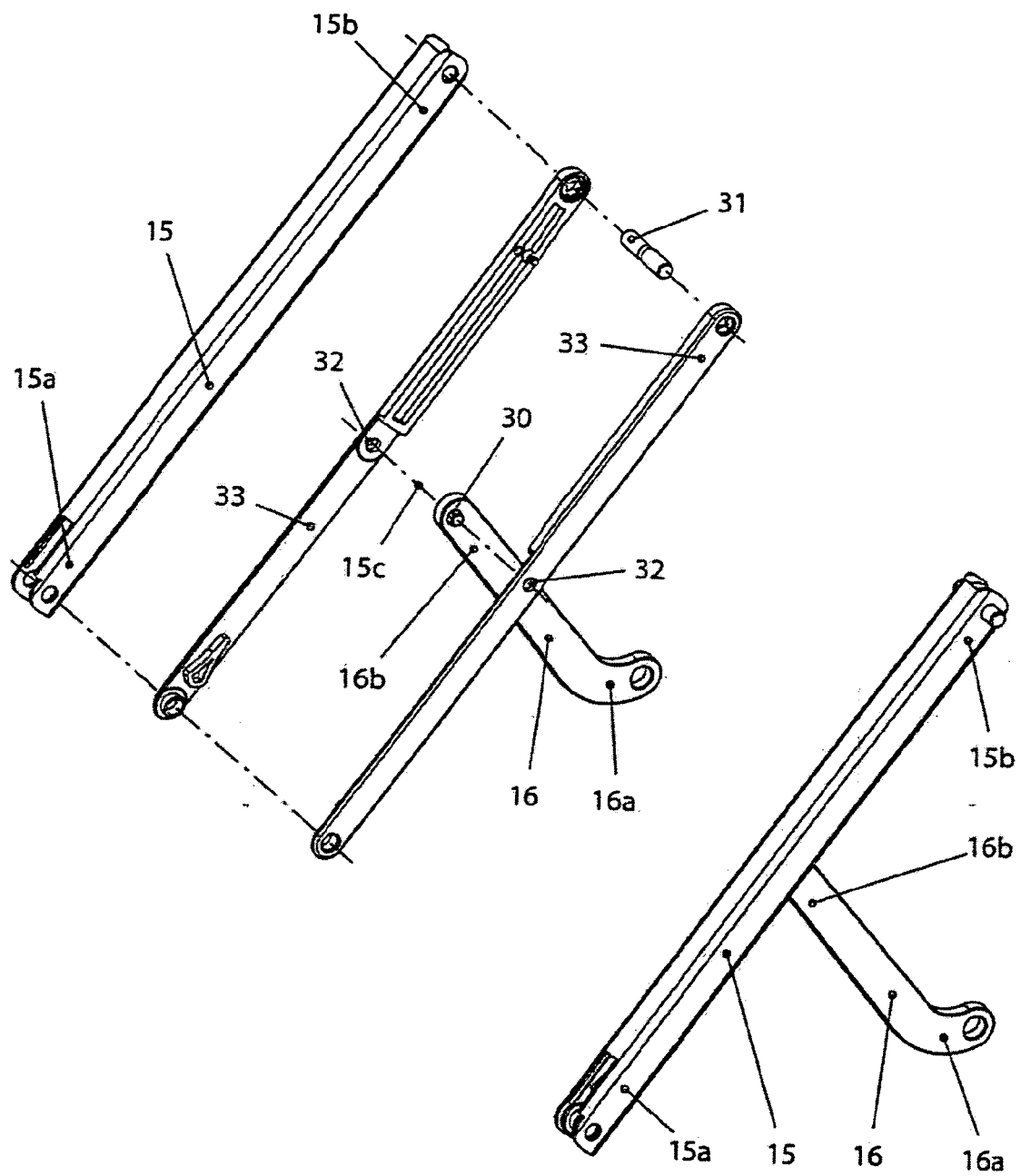
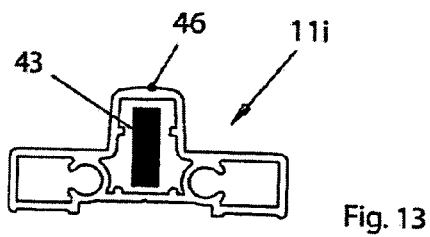
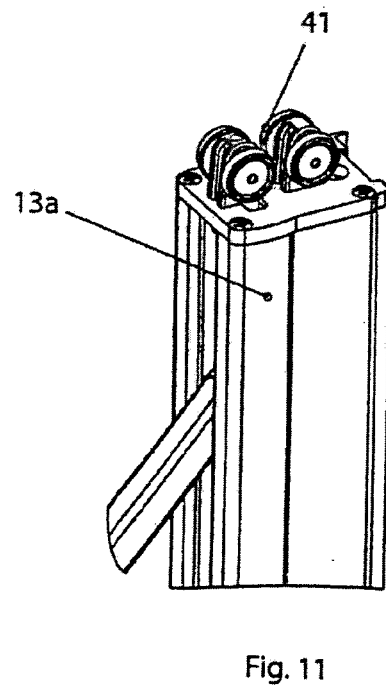
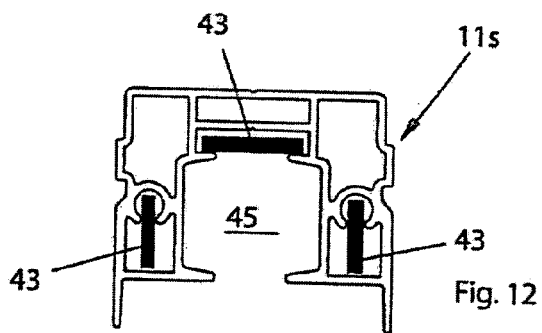
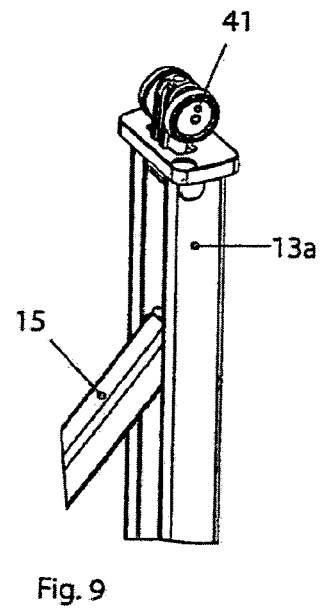
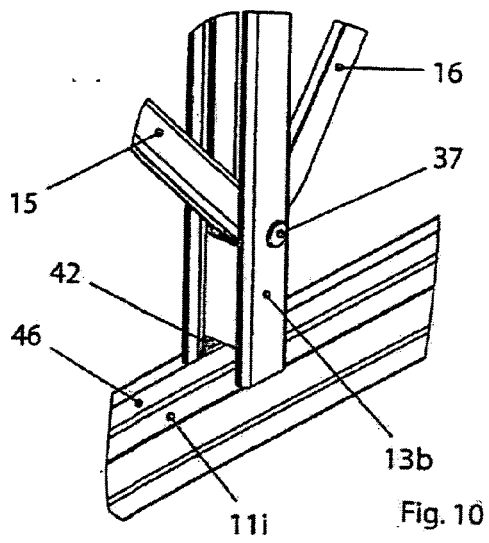
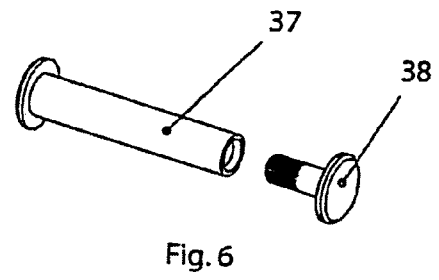
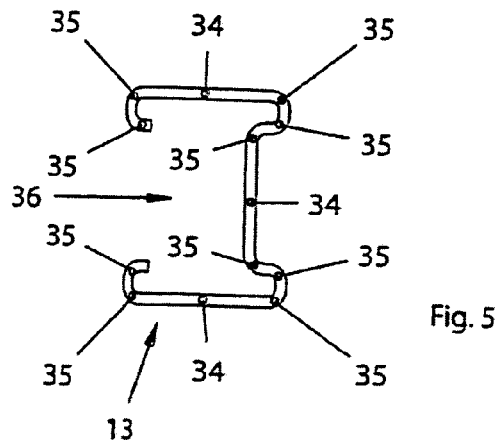


Fig. 4



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4006768 A [0009]