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(54) SLIDING DOOR OR WINDOW ASSEMBLY WITH A DISPLACEABLE MULLION BAR

(57) A sliding door or window assembly (1) comprising: a frame (2) having a bottom sill (2c), a first fixed panel (3) and a second fixed panel (4), a first sliding panel (5) and a second sliding panel (6), said first and second sliding panels (5,6) each being displaceable between an open position and a closed position, said first and second sliding panel (5,6) arranged such that outer surfaces of said first and second sliding panels are arranged essentially co-planar with the outer surfaces of the first and the second fixed panel (3,4) when the first and second sliding panels (5,6) are in their closed positions, a vertically arranged mullion bar (10) arranged between the first and second sliding panels, and being connected to the second sliding panel such that when the second sliding panel displaces to its open position, the mullion bar follows the second sliding panel. The assembly further comprises a mullion bar displacement mechanism (52,56,62,76) connecting the mullion bar (10) and the second sliding panel (6), said mullion bar displacement mechanism (52,56,62,76) being arranged such that at least a portion of the mullion bar (10) is displaceable with respect to the second sliding panel (6).

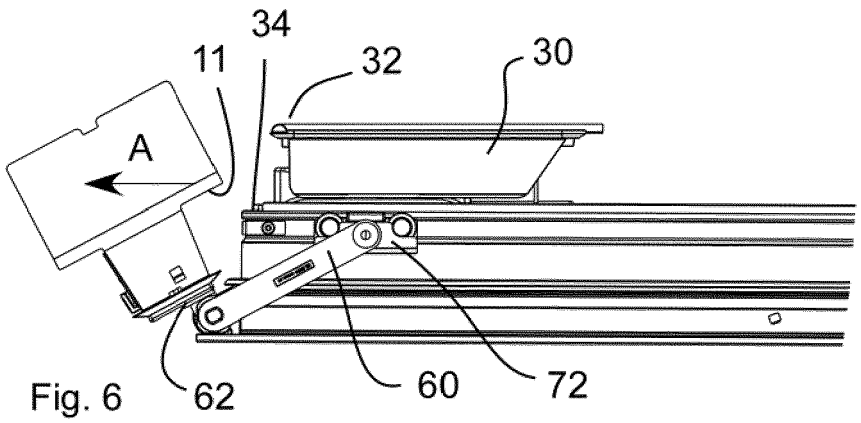

Fig. 6

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Description

[0001] The current invention relates to a sliding door or window assembly with a displaceable mullion bar. In particular the current invention relates to a sliding door or window assembly comprising: a frame having a bottom sill, a first fixed panel and a second fixed panel, said first and second fixed panels being arranged in the frame at opposite sides of the frame and such that an outer surface of the first fixed panel is essentially co-planar with an outer surface of the second fixed panel, a first sliding panel and a second sliding panel positioned between the first and second fixed panels, said first and second sliding panels each being displaceable between an open position and a closed position along a vector which has a major component along a direction which is parallel to the plane of the fixed panels, said first and second sliding panel arranged such that outer surfaces of said first and second sliding panels are arranged essentially co-planar with the outer surfaces of the first and the second fixed panel when the first and second sliding panel are in their closed positions, a vertically arranged mullion bar arranged between the first and second sliding panels and arranged to abut both the first and the second sliding panels in a sealed manner when the first and second sliding panels are in their closed positions, and being connected to the second sliding panel such that when the second sliding panel displaces to its open position, the mullion bar follows the second sliding panel, a first and a second track arranged along a direction which is essentially parallel with the plane of the first and second fixed panels respectively, a first and a second wagon arranged to be displaceable along the first and second tracks respectively, a first displacement mechanism connecting the first wagon and the first sliding panel and a second displacement mechanism connecting the second wagon and the second sliding panel, the first and second displacement mechanisms being arranged such that the first and second sliding panels are displaceable with respect to the first and second wagons respectively in a direction having a vector component which is perpendicular to the plane of the sliding panels.

[0002] For the sake of the current specification, the term mullion bar should be understood as a vertically extending profile which seals the interface between two displaceable sliding panels in the closed position of the panels or between a sliding panel and a fixed panel in the closed position of the sliding panel.

[0003] For the sake of the current specification, the term "sealing interface" should be understood as the interface or connection between two individual, and with respect to each other displaceable elements, which creates a weatherproof seal between the two elements when they are in their closed or sealed position. The term "sealing surface" should be understood as a surface of an element which forms one part of a "sealing interface". In other words, when two elements come into contact with each other to form a sealing interface, the surfaces on the parts which are in contact with each other will be termed "sealing surfaces".

[0004] It should also be noted that for the current specification, the terms inner and outer refer to the two sides of a wall in which the door or window assembly is mounted. In most cases the door/window assembly will be mounted in an exterior wall where the term inner side refers to the interior side of the wall and the term outer side refers to the exterior side of the wall. However, in a situation where the door/window assembly is mounted in an interior wall, the terms inner and outer can be interpreted as the first and second major surface of the assembly respectively. An object which is on the inner side of the assembly will be located closer to the inner side of the wall and an object which is on the outer side of the assembly will be located closer to the outer side of the wall.

[0005] Furthermore, the terms upper and lower should be understood as referring to the position in which the door or window assembly is to be mounted. If in doubt, the orientation shown in the figures should be used.

[0006] In typical embodiments, the assembly could also comprise a third displacement mechanism connecting a third wagon and the first sliding panel and a fourth displacement mechanism connecting a fourth wagon and the second sliding panel. In such embodiments, the first and third displacement mechanisms support the first sliding panel and the second and fourth displacement mechanisms support the second sliding panel.

Description of related art

[0007] Sliding doors/window assemblies typically comprise two panels arranged beside each other, a fixed panel which is fixed in position and a sliding panel which slides relative to the fixed panel. This is typical for assemblies which comprise glass panes as the panels. However, in certain cases, sliding door or window assemblies are provided without a "fixed panel" as such. One could imagine a case where the assembly comprises a sliding panel which is placed adjacent a fixed wall section. Or the sliding panel could be arranged to slide past a fixed post element instead of a fixed panel element. However, for the sake of the current specification, in the case where the sliding panel is arranged next to a fixed wall section, or a fixed post element, the fixed wall section and/or the fixed post element should be interpreted as the fixed panel element according to the claims.

[0008] In most cases, the sliding panels are connected to wagons which slide on a track. Typically, the track will be arranged parallel with the plane of the sliding panel in the closed position of the door. Typically, the track will be arranged underneath the fixed panel such that the track is hidden from view underneath the fixed panel. However, in certain embodiments, the track could be arranged above the sliding panel and the wagons could be hung on the track. Typically, the sliding panel will be connected to two wagons, one arranged at each side of the

sliding panel. The wagons will typically run along the same track, but in certain cases, there could be a different track for each wagon.

[0009] Sliding window and door assemblies can furthermore be classified into one of two main kinds. In a first kind of sliding door, when the door is in its closed position, the fixed and sliding panels are arranged parallel but offset from each other in a direction perpendicular to the plane of the panels. In one typical example, the inner surface of the sliding panel is arranged outside the outer surface of the fixed panel. In another typical example, the outer surface of the sliding panel is arranged inside the inner surface of the fixed panel. In both these cases, the sliding panel can slide past the fixed panel in an easy manner without requiring any large displacements of the sliding panel perpendicular to the panel. Typically a small perpendicular displacement is provided when opening/closing the assembly in order to protect the seal between the frame and the sliding panel when sliding the sliding panel relative to the frame.

[0010] A disadvantage of this type of sliding door/window assembly is that in the closed position, the outer surfaces of the fixed and sliding panels are in separate planes. The same is true for the inner surfaces. This means that the outer and inner visual impression made by the door is less harmonious. This disharmonious visual appearance will be more apparent as the sliding panel gets thicker. With current developments in door/window assemblies where very thick multiple glazed window pane assemblies are becoming standard, the disharmonious visual impression is very significant.

[0011] In a second type of sliding door, when the sliding panel is in its closed position, the fixed panel and the sliding panel are arranged in line with each other. In general, it is usually desired that the outer surface of the sliding panel is in the same plane as the outer surface of the fixed panel when the door is closed. Other times, it is desired that the inner surface of the sliding panel is in the same plane as the inner surface of the fixed panel. In this way, a more harmonious outer and/or inner visual appearance is provided respectively. If the thickness of the fixed panel and the sliding panel are the same, then both the outer and inner surfaces of the fixed and sliding panels can be arranged co-planar when the door is closed. This gives a harmonious outer and inner visual impression. This harmonious visual appearance is provided no matter how thick the panel construction is.

[0012] A disadvantage of this type of construction is that in order to allow the sliding panel to slide past the fixed panel, it is first necessary to displace the sliding panel a distance perpendicular to the plane of the sliding panel at the start of the opening process. The distance which needs to be displaced should be greater than the thickness of the sliding panel perpendicular to the plane of the sliding panel. In an inwardly opening sliding door assembly, the sliding panel needs to be displaced inwardly until the outer surface of the sliding panel is inside the inner surface of the fixed panel. In an outwardly opening sliding door assembly, the sliding panel needs to be displaced outwardly until the inner surface of the sliding panel is outside the outer surface of the fixed panel. Due to the thickness and weight of modern sliding panels made from multiple glazed glass panes, the mechanisms used for displacing the sliding panel need to be quite strong.

[0013] The current invention relates to the second type of sliding door or window assembly where the fixed and sliding panels are arranged inline when the door is closed and where the sliding panel needs to be displaced outwardly or inwardly at least the width of the sliding panel so that it can slide past the fixed panel. Some examples of this type of sliding door are provided in DE2700598C2, DE3725617A1, DE3810944A1, DE8435367U1, EP90956B1, EP222091B1, EP619410B1, EP1645707A1, EP2216472B1, EP2685040A2 and EP2690241A1.

[0014] Many of the prior art sliding door or window assemblies, for example the ones discussed above, have a large bottom sill height. A large bottom sill height is not desired since it will be in the way of the door opening. This is especially problematic for wheelchair users. Applicant's own patent application published as EP 3029247 discusses this problem in greater detail and proposes a solution based on a sealing plate attached to one of the wagons. EP 3029247 is incorporated by reference into this application in its entirety.

[0015] In certain cases, it is desired to have a large window or door area and in this case, it can be desired to place two sliding door and window assemblies beside each other. In one typical situation, two sliding door or window assemblies will be placed beside each other where the two assemblies are mirrored versions of each other, such that the two sliding panels will be arranged adjacent with the two fixed panels arranged at either side of the combined double assembly. For example, the double assembly could comprise a configuration seen from left to right of first fixed panel, first sliding panel, second sliding panel and second fixed panel. In this case, the two sliding panels will be displaceable, each to their own side. For example, the first sliding panel will be displaceable to the left and the second sliding panel will be displaceable to the right.

[0016] In a standard configuration, two identical sliding door or window assemblies will be arranged adjacent each other. This will result in a post in the middle of the door/window opening when the two sliding panels have been displaced to each their side. In order to avoid this post, sliding door or window assemblies have been provided previously with a displaceable mullion bar connected to the second sliding panel. When the sliding panels are in their closed position, the mullion bar will form a seal against both the first and the second sliding panels. When the assembly is opened, the mullion bar will be pushed to the side together with the second sliding panel, thereby leaving an opening which is not blocked by a post. An example of a double door arrangement is dis-

closed in figures 15-17 of US2014325912A1.

[0017] However, it has been discovered that previous solutions for these types of double sliding door or window assemblies are not suitable for modern door or window assemblies with thick sliding panels and/or for door or window assemblies arranged to have a low bottom sill height.

Summary of the invention

[0018] A first aspect of the current invention is therefore to provide a double sliding door or window assembly of the above described kind which is suitable for use with door or window assemblies having thick sliding panels and/or for use with door or window assemblies having a low bottom sill height.

[0019] This is provided by an assembly as specified in the introductory paragraph further modified by the features of the characterizing portion of claim 1. In this way, at least a portion of the mullion bar can be moved away from the wagon when the sliding panel is to be opened such that the wagon or any components connected to the wagon does not collide with the mullion bar. According to the current specification, the phrase "at least a portion of the mullion bar" should be understood as a portion of the mullion bar element itself. There will typically be smaller elements such as locking levers, handles, etc which move with respect to the mullion bar, however, these should not be understood as "a portion of the mullion bar". It should be understood that depending on the position and the arrangement of the mullion bar displacement mechanism, a situation could arise were a portion of the mullion bar was moving in one direction and a portion of the mullion bar was moving in another direction. This will typically occur in the case where the mullion bar is being rotated.

[0020] In one embodiment, the displacement of the mullion bar could be a linear, an angular and/or a pivotal displacement. In one embodiment, at least a portion of the mullion bar could be displaceable relative to the second sliding panel in a direction having a vector component which is perpendicular to the longitudinal extension of the mullion bar. In one preferred embodiment, at least a portion of the mullion bar could be displaceable away from the second sliding panel in a direction having a vector component which is parallel with the plane of the second sliding panel and perpendicular to the longitudinal extension of the mullion bar.

[0021] In a more specific embodiment, the mullion bar could comprise a sealing surface abutting a corresponding sealing surface of the second sliding panel when the second sliding panel is in its closed position, and said mullion bar displacement mechanism being arranged such that said sealing surface of said mullion bar could be displaceable away from the second sliding panel in a direction having a vector component which is parallel with the plane of the second sliding panel. In one embodiment the mullion bar could comprise a sealing surface, said sealing surface abutting a corresponding sealing surface of the second sliding panel when the second sliding panel is in its closed position and not abutting the corresponding sealing surface of the second sliding panel when the second sliding panel is in its open position.

[0022] In another rather specific embodiment, a portion of the mullion bar arranged inside the inner surface of the second sliding panel could be displaceable as described in one of the embodiments above. In another version, a portion of the mullion bar arranged inside the second wagon could be displaceable as described in one of the embodiments above.

[0023] In an embodiment, the mullion bar and the mullion bar displacement mechanism could be adapted such that the displacement of the mullion bar with respect to the second wagon has a displacement component which is in the same direction as the displacement of the second sliding panel with respect to the second wagon. One option is that the displacement could have a vector component which is perpendicular to the plane of the sliding panels.

[0024] In one preferred embodiment, the mullion bar displacement mechanism could be arranged to rotate the mullion bar about an axis which is parallel to the longitudinal extension of the mullion bar. Rotation is a beneficial solution if there are other components in the system which are rotating naturally during the opening of the assembly.

[0025] In one embodiment, the mullion bar displacement mechanism could be connected to the second displacement mechanism such that the displacement of the mullion bar is controlled by the motion of the second displacement mechanism. During the opening of the sliding panel, the second displacement mechanism will typically have at least one component which is moving relative to the second panel. Connecting this at least one moving component to the mullion bar displacement mechanism provides for a simple solution to activate the mullion bar displacement mechanism.

[0026] In one such embodiment, the second displacement mechanism could comprise an elongated arm pivotably connected to the second wagon at a first end of the elongated arm and pivotably connected to the second sliding panel at a second end of the elongated arm, said mullion bar displacement mechanism being mechanically connected to the elongated arm, such that rotation of the elongated arm relative to the second sliding panel, will cause a displacement of the mullion bar.

[0027] In one such embodiment, the mullion bar displacement mechanism could comprise a rod which is pivotably connected to the second sliding panel along a vertical side edge of the second sliding panel, the rod could be connected to the elongated arm of the second displacement mechanism such that rotation of the elongated arm with respect to the second sliding panel causes rotation of the rod with respect to the second sliding panel. By connecting the mullion bar and the rod together, the rotation of the elongated arm can also cause a synchro-

nized rotation of the mullion bar. In one embodiment, the rod could be arranged between the sliding panel and the mullion bar.

[0028] In one embodiment the mullion bar could be directly fastened to the rod such that the mullion bar rotates about the longitudinal axis of the rod in a direct relationship to the rotation of the rod. This can provide a simple and robust mechanism.

[0029] In one embodiment the mullion bar is connected to the rod such that the mullion bar rotates about the longitudinal axis of the rod in a direct relationship to the rotation of the rod over only a portion of the range of motion of the rod. In this embodiment, the connection between the rod and the mullion bar can be arranged with a certain amount of free rotation between the rod and the mullion bar so that the mullion bar at the start of its rotation can rotate away from the sliding panel, without simultaneous rotation of the connection rod. In another embodiment, instead of having a certain amount of free rotation between the mullion bar and the rod, there could be a certain amount of free rotation between the connection rod and the elongated arm. In this way, a direct connection could be established between the rod and the mullion bar, but the rod could freely rotate a certain amount with respect to the elongated arm before the arm started rotating together with the rod.

[0030] In one embodiment, the mullion bar displacement mechanism, the rod and the elongated arm could be directly interconnected such that the mullion bar extends from the rod at a fixed angle of approximately 90 degrees to the elongated arm. In one further embodiment, the mullion bar could be arranged with a certain amount of free rotation with respect to the rod, such that the mullion bar could extend from the rod at an angle of 90 degrees plus/minus a specified tolerance. In one example, the tolerance is less than plus/minus 20 degrees, in one embodiment it is less than plus/minus 15 degrees and in another embodiment it is less than plus/minus 10 degrees.

[0031] In one embodiment, the plane defined by the inner facing surface of the mullion bar in the closed position of the mullion bar can be arranged perpendicular to a plane defined by the outer surface of the sliding panel when the mullion bar is in its fully open position. In this way the width of the door opening can be optimized.

[0032] In one embodiment, the longitudinal axis of the rod could be arranged coaxially with the rotation axis of the pivotable connection between the elongated arm and the second sliding panel. In this way, it is simple to connect the rod with the elongated arm.

[0033] In some embodiments, the second wagon could be arranged underneath the second sliding panel when the assembly is closed. This provides for a compact structure.

[0034] In order to reduce the height of the bottom sill, the assembly could further comprise a sealing plate which in the closed position of the second sliding panel: is arranged between the second wagon and a sealing surface of the bottom sill, is provided with an upper sealing surface which establishes an upper sealing interface between the sealing plate and the second sliding panel and which comprises a portion which is located above the uppermost edge of the second wagon and is provided with a lower sealing surface which establishes a lower sealing interface between the sealing plate and the sealing surface of the bottom sill and which comprises a portion which is located below the uppermost edge of the second wagon. In this way, a lower bottom sill height can be achieved.

[0035] In one embodiment, the sealing plate could be arranged to displace with respect to the bottom sill and with respect to the second sliding panel as the second sliding panel moves from its closed position to its open position. In one embodiment, the sealing plate could be connected to the second wagon such that it displaces together with the second wagon when the second wagon displaces along the track.

[0036] In one specific embodiment, the second sliding panel could further comprise an elongated sealing profile which is fixedly connected to or otherwise incorporated into the second sliding panel along a bottom edge of the second sliding panel and which is provided with the bottom sealing surface which establishes the sealing interface between the bottom edge of the sliding panel and the bottom sill when the second sliding panel is in its closed position, at least a portion of said sealing interface being located between the second wagon and the sealing surface of the bottom sill and at least a portion of said sealing interface being located below the uppermost edge of the second wagon, and said sealing profile being provided with an opening, said opening defining an area in a plane which is parallel to the plane of the second sliding panel and being arranged in the vicinity of the second wagon in the closed position of the second sliding panel whereby the second wagon can pass through said opening in the sealing profile when moving the second sliding panel from its closed position to its open position and in that said sealing plate is arranged to seal the opening when the second sliding panel is in its closed position. One embodiment of this kind is described in greater detail in the description and the figures of this specification.

[0037] In at least some embodiments, the assembly could be arranged such that in the open position of the second sliding panel, the upper sealing surface of the sealing plate is not in sealing contact with the sliding panel and/or the lower sealing surface of the sealing plate is not in sealing contact with the sealing surface of the bottom sill. In one embodiment the mullion bar could abut the sealing plate in the closed position of the second sliding panel. In one embodiment, the mullion bar does not abut the sealing plate in the open position of the second sliding panel.

[0038] In one embodiment, the first and second sliding panels have a bottom sealing surface which can be sealed against the sealing surface of the bottom sill of the frame in the closed position of the sliding panels to

provide a sealing interface between the bottom sill and the sliding panels.

[0039] It should be emphasized that the term "comprises/comprising/comprised of' when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof. Likewise, it should be clear that the embodiments are in the above presented as separate embodiments, but could be combined as desired by the person skilled in the art.

Brief description of the drawings

[0040] In the following, the invention will be described in greater detail with reference to embodiments shown by the enclosed figures. It should be emphasized that the embodiments shown are used for example purposes only and should not be used to limit the scope of the invention.

Figure 1 schematically shows a perspective view of an outwardly opening double sliding door assembly according to the current invention as seen from the outside and in the partially open position.

Figure 2 shows a perspective view of the sliding door assembly of figure 1 from the inside.

Figure 3 shows a detail perspective view of the area defined by the circle III in figure 2.

Figure 4 shows a partial top view of the mullion bar, the second sliding panel of the sliding door assembly and a portion of the second displacement mechanism of figure 1 in the closed position of the second sliding panel. The frame has been removed for the sake of clarity.

Figure 5 shows the same view as figure 4, but where the second sliding panel has been hidden.

Figure 6 shows a partial top view as in figure 4, but where the second sliding panel is in an intermediary position.

Figure 7 shows a partial top view as in figure 4, but where the second sliding panel is in its fully open position.

Figure 8 shows an inside partial perspective view showing the bottom portion of the mullion bar, a portion of the second displacement mechanism, a portion of the mullion bar displacement mechanism and a portion of the second sliding panel.

Figure 9 shows the same view as figure 8, but where the second sliding panel has been hidden.

Figure 10 shows an inside partial perspective view of the top portion of the mullion bar together with a top corner of the second sliding panel, a portion of the second displacement mechanism and a portion of the mullion bar displacement mechanism.

Figure 11 shows an inside partial perspective view of the middle portion of the mullion bar and the mullion bar displacement mechanism, but where the second sliding panel has been hidden.

Figure 12 shows an outside partial perspective view of the middle portion of the mullion bar and the mullion bar displacement mechanism as defined by XII in figure 1, but where the second sliding panel has been hidden.

Figure 13 shows a schematic side view of the bracket which connects the connection rod and the mullion bar together.

Detailed description of the embodiments

[0041] Figures 1-13 show different views of one embodiment of an outwardly opening double sliding door assembly according to the invention.

[0042] The sliding door assembly 1 comprises a frame 2, a first fixed panel 3 arranged in a first opening in the frame at the left side of the frame when looking from the outside, a second fixed panel 4 arranged in a second opening in the frame at the right side of the frame, a first sliding panel 5 arranged adjacent to and to the right of the first fixed panel and a second sliding panel 6 arranged adjacent to and to the left of the second fixed panel. The frame is mounted in a wall opening (not shown) as is well known in the art. The frame comprises four outer frame elements 2a,2b,2c,2d forming the periphery of the frame. The frame further comprises a first mullion bar 7 arranged between the first fixed panel and the first sliding panel and a second mullion bar 8 arranged between the second fixed panel and the second sliding panel.

[0043] The sliding panels 5,6 are arranged to have an open position where they are displaced away from each other such that an opening 9 is formed in the frame and a closed position where they are displaced towards each other such that the door opening 9 is closed. The sliding door/window assembly of the current invention is of the kind where the outer surfaces and/or the inner surfaces of the sliding panels and the fixed panels are essentially co-planer in the closed position of the assembly. When the assembly is to be opened, the sliding panels must first be displaced perpendicular to the plane of the sliding panels, before the sliding panels can be displaced to the sides. Figures 1 and 2 show a situation where the first panel is halfway opened and the second panel is also half way opened. In order to fully open the door assembly of figure 1 and 2, the first sliding panel is displaced further to the left and the second sliding panel is displaced further

to the right. In order to close the assembly, the second sliding panel is first displaced to the left until it reaches its closed position. Once the second sliding panel is completely closed and fixed in position, the first sliding panel can be displaced to the right until it also reaches its closed position.

[0044] In the embodiment shown, the fixed panels and the sliding panels are assembled from similar extruded sash elements and therefore have similar cross sections. The fixed panels are fixed in the first and second frame openings via fixed sash fittings which connect the sash to the frame in a fixed manner. In contrast, the sliding panels are mounted in the frame via sliding door fittings. The person skilled in the art will be familiar with this type of construction and more details will not be provided here.

[0045] Between the first and second sliding panels, a mullion bar 10 is arranged to seal the interface between the first and second sliding panels in the closed position of the sliding panels. In traditional constructions, the mullion bar would be fixed in place in the frame and both the first and second sliding panels would abut and contact the fixed mullion bar in their closed positions. When opening the door, the first and second sliding panels would displace away from each other and away from the mullion bar. This would mean that there would be a mullion bar in the middle of the window/door opening in the open position of the sliding panels.

[0046] In contrast, in the assembly according to the current invention, the mullion bar 10 between the first and second sliding panels is attached to the second sliding panel 6 and displaces together with the second sliding panel when the second sliding panel is displaced to the side. Hence, the mullion bar is removed from the window/door opening when the second sliding panel is displaced. This leaves the window/door opening completely free of any mullion bars when the first and second sliding panels are in their open positions.

[0047] Figure 3 shows a detailed view of the inside bottom portion of the second sliding panel 6 showing the details of the displacement mechanism used to displace the second sliding panel outwardly. The figure shows a track 20 arranged on the bottom sill 2c of the frame. A wagon 21 is arranged to slide along the track 20 in the direction along the longitudinal direction of the track. An elongated arm 24 is pivotably attached to the wagon at a first end of the arm and is pivotably attached to the second sliding panel 6 at a second end of the arm. The elongated arm, allows the sliding panel to displace outwardly with respect to the track/wagon when the door is to be opened. Once the second sliding panel is pushed fully outwards, the sliding panel can then be displaced by sliding the wagons. This form of sliding door mechanism is well known in the art and won't be described in more detail here. It should be noted that many different types of such sliding door mechanisms could be used together with the current invention.

[0048] As was mentioned in the introduction of this specification, it is often desired to reduce the height of the bottom sill. In this current embodiment, this is provided by arranging a sealing profile 26 along the bottom and inside edge of the sliding panel. The sealing profile 26 has a lower edge which forms a lower sealing surface 26b which abuts a sealing surface 13 on the bottom sill 2c of the frame in the closed position of the second sliding panel 6. A recess or opening 28 is cut into the sealing profile 26 in the vicinity of the wagon 21. A sealing plate 30 is attached to the wagon. When the sliding panel is in its closed position, the sealing plate will seal the recess in the sealing profile. The sealing plate 30 is arranged between the wagon 21 and the sealing surface 13 of the bottom sill 2c. Likewise, a lower edge of the sealing plate forms a lower sealing surface 30b which seals against the sealing surface 13 of the bottom sill 2c in the closed position of the sliding panel. Likewise, the sealing plate 30 has a top edge which forms an upper sealing surface 30a which seals against the opening 28 in the sealing profile 26 in the closed position of the second sliding panel. It should be noted that in the current embodiment, the lower sealing surface 30b of the sealing plate and the lower sealing surface 26b of the sealing profile are both located below the upper surface of the wagon 21. Likewise, the upper sealing surface 30b of the sealing plate in the current embodiment is located above the upper surface of the wagon 21.

[0049] In figure 4, it can be seen that the vertical side edge of the second sliding panel closest to the mullion bar 10 overlaps the mullion bar in the closed position of the sliding panel. However, as can be seen in figure 5, in the current embodiment, a portion of the sealing plate 30, also overlaps the mullion bar in the closed position of the sliding panel. Since the mullion should displace outwardly and the sealing plate 30 is to remain fixed in place on the wagon, when opening the door, the mullion bar would have to go through the sealing plate. In order to allow the door to open, the mullion bar in the current embodiment is arranged to pivot away from the vertical side edge of the second sliding panel so that the mullion bar can pass by the sealing plate. This is shown in figures 6 and 7 where it can be seen that as the sliding panel displaces outwardly with respect to the wagon 21 and the sealing plate 30, the mullion bar pivots relative to the sliding panel about an axis which is parallel to the vertical side edge of the sliding panel.

[0050] In more detailed terms, the mullion bar has a sealing surface 11 which abuts an inner surface 32 of the sealing plate 30 and an inner surface 34 of the sliding panel 6 in the closed position of the sliding panel 6. When the sliding panel is displaced outwardly, the sealing surface 11 of the mullion bar is displaced away from the sliding panel. In the current embodiment, the displacement occurs by pivoting the mullion bar about an axis parallel to the longitudinal extension of the mullion bar and the vertical side edge of the sliding panel. However, the most interesting component of displacement is a component A which is parallel to the plane of the sliding panel and perpendicular to the longitudinal axis of the

mullion bar. This displacement could be achieved by motions other than rotation. For example, the mullion bar could be displaced linearly away from the sliding panel.

[0051] In the current embodiment, the displacement of the mullion bar with respect to the sliding panel is provided by a mullion bar displacement mechanism. The mullion bar displacement mechanism in this embodiment is integrated into the displacement mechanism for the second sliding panel as described above with regards to figure 3. The function of the mullion bar displacement mechanism will be better described with regards to figures 8-13.

[0052] Figure 8 shows the bottom portion of the sliding panel in more detail. Figure 9 shows the same as figure 8, but where the sash and glazing pane have been removed to more clearly see the details of the displacement mechanism. An L-shaped bracket 40 is attached to the bottom corner of the sash. A bottom leg 42 of the bracket is fastened to the bottom side edge of the sash and an elongated side leg 44 of the bracket is attached to the vertical side edge of the sash. A hollow cylindrical tube 46 is integrated with the elongated side leg 44 of the bracket. An axle (hidden) which is fastened to the end of the elongated member 24 is inserted into the lower end of the hollow cylindrical tube 46 and allows the bracket 40 to pivot with respect to the axle. The axle is fastened to the elongated member 24 such that when the elongated member rotates with respect to the sliding panel, the axle will also rotate with respect to the sliding panel inside the hollow cylindrical tube 46 of the bracket 40. The bottom portion 48 of the hollow tube 46 rests on a support surface 50 on the elongated arm. The axle, the bracket and the elongated arm are arranged to support a large portion of the weight of the second sliding panel.

[0053] A connection rod 52 is inserted into the upper end 54 of the hollow cylindrical tube 46. The connection rod is free to rotate within the cylindrical tube and is connected to the axle at the end of the elongated member 24, such that when the axle rotates, the connection rod will also rotate the same amount. This is for example provided by arranging the end of the axle and the connecting end of the connection rod in a form fitting relationship.

[0054] A bracket 56 is fastened to the mullion bar 10. The bracket has a cylindrical portion 58 which is connected to the connection rod 52 such that when the connection rod rotates, the bracket 56 and the mullion bar 10 are also rotated (note however the discussion with regards to the form of the connection which is discussed below).

[0055] In this way, when the sliding panel is displaced outwardly, the elongated member 24 will pivot outwardly, this will cause the axle on the elongated arm to pivot inside the hollow cylindrical tube 46. This will cause the connection rod 52 to pivot as well. This will cause the mullion bar to pivot the same amount. This can be seen with reference to figures 4-7, where it can be seen that the mullion bar pivots outwardly the same amount as the elongated member. It should be noted that in figures 4-7, the assembly is shown from the top and the elongated member 60 shown in figures 4-7 is an elongated member 60 arranged at the top of the window construction. However, the top elongated member 60 and the bottom elongated member 24 follow each other and rotate together. The connection rod 52 connects the top and bottom elongated members 60 so that they both rotate the same amount.

[0056] From figure 10, one can see more details of the top mechanism. Since the top mechanism does not need to support as much weight, the top elongated arm 60 is not as strong as the bottom elongated arm 24. As in the bottom mechanism, the connection rod 52 is connected to a top bracket 62 which is fastened to the mullion bar 10 near the top of the mullion bar. Likewise, the top portion 64 of the connection rod is rotateably supported by a bracket 66 fastened to the vertical side edge of the sliding panel. The outer end 68 of the top elongated member 60 is fastened to the connection rod 52 so that rotation of the connection rod causes a rotation of the top elongated member. The inner end 70 of the top elongated member is pivotably fastened to a wagon 72 running in a track (not shown) at the top of the assembly.

[0057] Figure 11 shows the middle portion of the assembly where the sash has been hidden for the sake of clarity. A bracket 74 is fastened to the side edge of the sliding panel/sash 6, similar to the top bracket 66 and the bottom L-shaped bracket 40. The bracket 74 comprises a hollow cylindrical portion 75 in which the connection rod 52 is pivotably arranged. Likewise, a bracket 76 is attached to the mullion bar 10 and is fastened to the connection rod 52 such that when the connection rod rotates, the mullion bar 10 also rotates.

[0058] In the current embodiment, the mullion bar is placed close to the wagon and sealing plate in the closed position of the door. When the door is opened, the door will try to move outwards at the start, thereby also causing the mullion bar to come into contact with the wagon. In order to avoid this situation, in the current embodiment, the mullion bar is arranged with a small amount of free rotation with regards to the rotating connection rod. In this way, it is possible to rotate the mullion bar slightly outwardly, before the door is opened. This allows the mullion bar to displace to the side and out of the way of the wagon prior to opening the door.

[0059] In a typical use case, the user would first open the first sliding panel 5 and push it to the side. Then the user would hold the mullion bar and release any locking mechanism which holds the mullion bar in place. In the current embodiment, there are locking pins (not shown) which extend from the top and bottom of the mullion bar and extend into openings in the top and bottom frame members 2a, 2c. Once the mullion bar is released, the user would rotate the mullion bar outwardly by taking advantage of the free rotation/play between the mullion bar and the connection rod. Once the mullion bar engages the connection rod, further rotation of the mullion bar

will cause the door to displace outwardly and then the door can be pushed to the side.

[0060] The free rotation/play can be implemented in many different ways. In figures 12 and 13, one embodiment of a suitable mechanism is shown. In this embodiment, the bracket 76 which connects the mullion bar to the connection rod 52 is formed with a hollow cylindrical section 77 in which the connection rod is freely rotatable. On one side of the bracket, is formed an oval opening 78 through which there is access to the cylindrical side portion 79 of the connection rod 52. A hole 80 is provided in the cylindrical side portion 79 of the connection rod and a pin (not shown) is mounted in the hole. The pin extends a certain distance out of the hole and the diameter D of the pin is smaller than the width W of the oval opening 78. In this way, the bracket can rotate slightly with respect to the connection rod until the pin comes into contact with the sides of the oval opening 78. When the direction of rotation changes, there is again a period where the mullion bar can rotate with respect to the connection rod until the pin again comes into contact with the other side of the oval opening. It should be clear to the person skilled in the art that this free rotation effect can be implemented in different ways. One example (not shown) would be that there is a direct connection between the connection rod and the mullion bar, but that there is some "play" or free rotation between the connection rod and the elongated arm 24.

[0061] It should be noted that this small amount of free rotation or "play" is necessary in some embodiments where the mullion bar and the wagon/sealing plate are placed closed together. However, in other embodiments, a direct connection between the connection rod and the mullion bar could be imagined.

[0062] Another benefit from this free rotation effect, is that the mullion bar can be rotated more than the amount that the connection rod rotates. For example, in figure 7, the mullion bar has a slight angle with regards to the plane of the door. With the extra free rotation, the mullion bar can be rotated a bit more outwardly than shown in figure 7. In the case where the mullion bar is rotated such that the plane defined by the inner facing surface 81 of the mullion bar is arranged perpendicular to the plane defined by the outer surface of the sliding panel, the extension of the mullion bar into the door opening will be reduced slightly. This will provide a slightly broader door opening.

[0063] As mentioned previously in this specification, the description above has only shown one main example embodiment of a double sliding door assembly according to the invention with some different variations in individual components. However, it should be clear to the person skilled in the art, that the invention could also be applied to a sliding window assembly with the same benefits. Likewise, as mentioned previously, the example shows an outwardly opening door assembly. A similar inwardly opening door/window assembly could also be provided according to the current invention. The terms used in the description have therefore referred to an outwardly opening assembly. However, the person skilled in the art will be able to understand that when designing an inwardly opening door or window assembly based on the teachings of the current specification, the terms inside and outside will be reversed.

[0064] It is to be noted that the figures and the above description have not described all mechanical components of the system in detail. The person skilled in the art should be able to provide the missing details. For example, details about the locking mechanisms have not been provided, since these are not crucial to the current invention. However, the person skilled in the art could easily provide a suitable solution. Likewise, details of the wagons, the tracks, the fittings, the bushings, etc have not been provided in detail as these are already available in the art. For further details of the sealing plate and sealing profile, the reader is referred to applicant's co-pending application EP 3029247 which is incorporated by reference into this application in its entirety.

Claims

1. A sliding door or window assembly (1) comprising:

a. a frame (2) having a bottom sill (2c),
b. a first fixed panel (3) and a second fixed panel (4), said first and second fixed panels being arranged in the frame at opposite sides of the frame and such that an outer surface of the first fixed panel is essentially co-planar with an outer surface of the second fixed panel,
c. a first sliding panel (5) and a second sliding panel (6) positioned between the first and second fixed panels (3,4), said first and second sliding panels (5,6) each being displaceable between a closed position and an open position along a vector which has a major component along a direction which is parallel to the plane of the fixed panels, said first and second sliding panel (5,6) arranged such that outer surfaces of said first and second sliding panels are arranged essentially co-planar with the outer surfaces of the first and the second fixed panel (3,4) when the first and second sliding panels (5,6) are in their closed positions,
d. a vertically arranged mullion bar (10) arranged between the first and second sliding panels and arranged to abut both the first and the second sliding panels in a sealed manner when the first and second sliding panels are in their closed positions, and being connected to the second sliding panel such that when the second sliding panel displaces to its open position, the mullion bar follows the second sliding panel,
e. a first and a second track (20) arranged along a direction which is essentially parallel with the

plane of the first and second fixed panels respectively,

f. a first and a second wagon (21) arranged to be displaceable along the first and second tracks (20) respectively,

g. a first displacement mechanism (24) connecting the first wagon (21) and the first sliding panel (5) and a second displacement mechanism (24) connecting the second wagon (21) and the second sliding panel (6),

h. the first and second displacement mechanisms (24) being arranged such that the first and second sliding panels (5,6) are displaceable with respect to the first and second wagons respectively in a direction having a vector component which is perpendicular to the plane of the sliding panels,

i. **characterized in that** said assembly further comprises a mullion bar displacement mechanism (52,56,62,76) connecting the mullion bar (10) and the second sliding panel (6), said mullion bar displacement mechanism (52,56,62,76) being arranged such that at least a portion of the mullion bar (10) is displaceable with respect to the second sliding panel.

2. A sliding door or window assembly (1) according to claim 1, **characterized in that** said at least a portion of the mullion bar (10) is displaceable relative to the second sliding panel in a direction having a vector component which is perpendicular to the longitudinal extension of the mullion bar (10).

3. A sliding door or window assembly (1) according to any one of claims 1 to 2, **characterized in that** the mullion bar (10) comprises a sealing surface (11) abutting a corresponding sealing surface (32) of the second sliding panel (6) when the second sliding panel (6) is in its closed position, and said mullion bar displacement mechanism (52,56,62,76) being arranged such that said sealing surface (11) of said mullion bar (10) is displaceable away from the second sliding panel (6) in a direction having a vector component which is parallel with the plane of the second sliding panel (6).

4. A sliding door or window assembly (1) according to any one of claims 1 to 3, **characterized in that** the mullion bar (10) and the mullion bar displacement mechanism (52,56,62,76) are adapted such that the displacement of the mullion bar with respect to the second sliding panel (6) and/or the second wagon (21) has a displacement component which is in the same direction as the displacement of the second sliding panel (6) with respect to the second wagon.

5. A sliding door or window assembly (1) according to any one of claims 1 to 4, **characterized in that** the mullion bar displacement mechanism (52,56,62,76) is arranged to rotate the mullion bar (10) about an axis which is parallel to the longitudinal extension of the mullion bar.

6. A sliding door or window assembly (1) according to any one of claims 1 to 5, **characterized in that** the mullion bar displacement mechanism (52,56,62,76) is connected to the second displacement mechanism (24) such that the displacement of the mullion bar (10) is linked to and/or at least partially controlled by the motion of the second displacement mechanism (24).

7. A sliding door or window assembly (1) according to claim 6, **characterized in that** said second displacement mechanism (24) comprises an elongated arm (24) pivotably connected to the second wagon (21) at a first end and pivotably connected to the second sliding panel (6) at a second end, said mullion bar displacement mechanism (52,56,62,76) being mechanically connected to the elongated arm (24), such that the rotation of the elongated arm with respect to the second sliding panel, causes a displacement of the mullion bar (10) with respect to the second sliding panel durin at least a portion of the range of motion of the elongated arm.

8. A sliding door or window assembly (1) according to claim 7, **characterized in that** the mullion bar displacement mechanism (52,56,62,76) comprises a rod (52) which is pivotably connected to the second sliding panel (6) along a vertical side edge of the second sliding panel between the sliding panel and the mullion bar (10), said rod (52) being connected to the elongated arm (24) of the second displacement mechanism such that rotation of the elongated arm (24) with respect to the second sliding panel (6) causes rotation of the rod (52) with respect to the second sliding panel (6) during at least a portion of the range of motion of the rod.

9. A sliding door or window assembly (1) according to claim 8, **characterized in that** the mullion bar (10) is connected to the rod (52) such that the mullion bar (10) rotates about the longitudinal axis of the rod in a direct relationship to the rotation of the rod over at least a portion of the range of motion of the rod and **in that** the rod is free to rotate with respect to the mullion bar (10) over at least another portion of the range of motion of the rod.

10. A sliding door or window assembly (1) according to any one of claims 8 or 9, **characterized in that** the longitudinal axis of the rod (52) is coaxial with the rotation axis of the pivotable connection (46) between the elongated arm (24) and the second sliding panel (6).

11. A sliding door or window assembly (1) according to any one of claims 1 to 10, **characterized in that** the second wagon (21) is arranged underneath the second sliding panel (6) when the assembly is closed and/or **in that** a fourth wagon is arranged underneath the second fixed panel when the assembly is closed.

12. A sliding door or window assembly (1) according to any one of claims 1 to 11, **characterized in that** said assembly (1) further comprises

a. a sealing plate (30) which is arranged to be displaceable with respect to the second sliding panel and which in the closed position of the second sliding panel (6):

i. is arranged between the second wagon (21) and a sealing surface (13) of the bottom sill (2c),
ii. is provided with an upper sealing surface (30a) which establishes an upper sealing interface between the sealing plate (30) and the second sliding panel (6) and which comprises a portion which is located above the uppermost edge of the second wagon (30) and
iii. is provided with a lower sealing surface (30b) which establishes a lower sealing interface between the sealing plate (30) and the sealing surface (13) of the bottom sill (2c) and which comprises a portion which is located below the uppermost edge of the second wagon (30).

13. A sliding door or window assembly (1) according to claim 12, **characterized in that** the sealing plate (30) is arranged to displace with respect to the bottom sill (2c) and with respect to the second sliding panel (6) as the second sliding panel (6) moves from its closed position to its open position.

14. A sliding door or window assembly (1) according to any one of claims 12 to 13, **characterized in that** the second sliding panel (6) further comprises an elongated sealing profile (26) which is fixedly connected to or otherwise incorporated into the second sliding panel (6) along a bottom edge of the second sliding panel and which is provided with a bottom sealing surface (26b) which establishes a sealing interface between the bottom edge of the sliding panel (6) and the bottom sill (2c) when the second sliding panel (6) is in its closed position, at least a portion of said sealing interface being located between a plane formed by the inner surface of the second wagon (30) and a plane formed by the sealing surface (13) of the bottom sill (2c) and at least a portion of said sealing interface being located below the uppermost edge of the second wagon (30), and said sealing profile (26) being provided with an opening (28), said opening defining an area in a plane which is parallel to the plane of the second sliding panel (6) and being arranged in the vicinity of the second wagon (30) in the closed position of the second sliding panel (6) whereby the second wagon can pass through said opening (28) in the sealing profile (26) when moving the second sliding panel (6) from its closed position to its open position and **in that** said sealing plate (30) is arranged to seal the opening (28) when the second sliding panel (6) is in its closed position.

15. A sliding door or window assembly (1) according to any one of claims 12 to 15, **characterized in that** the mullion bar (10) abuts the sealing plate (30) in the closed position of the second sliding panel (6).

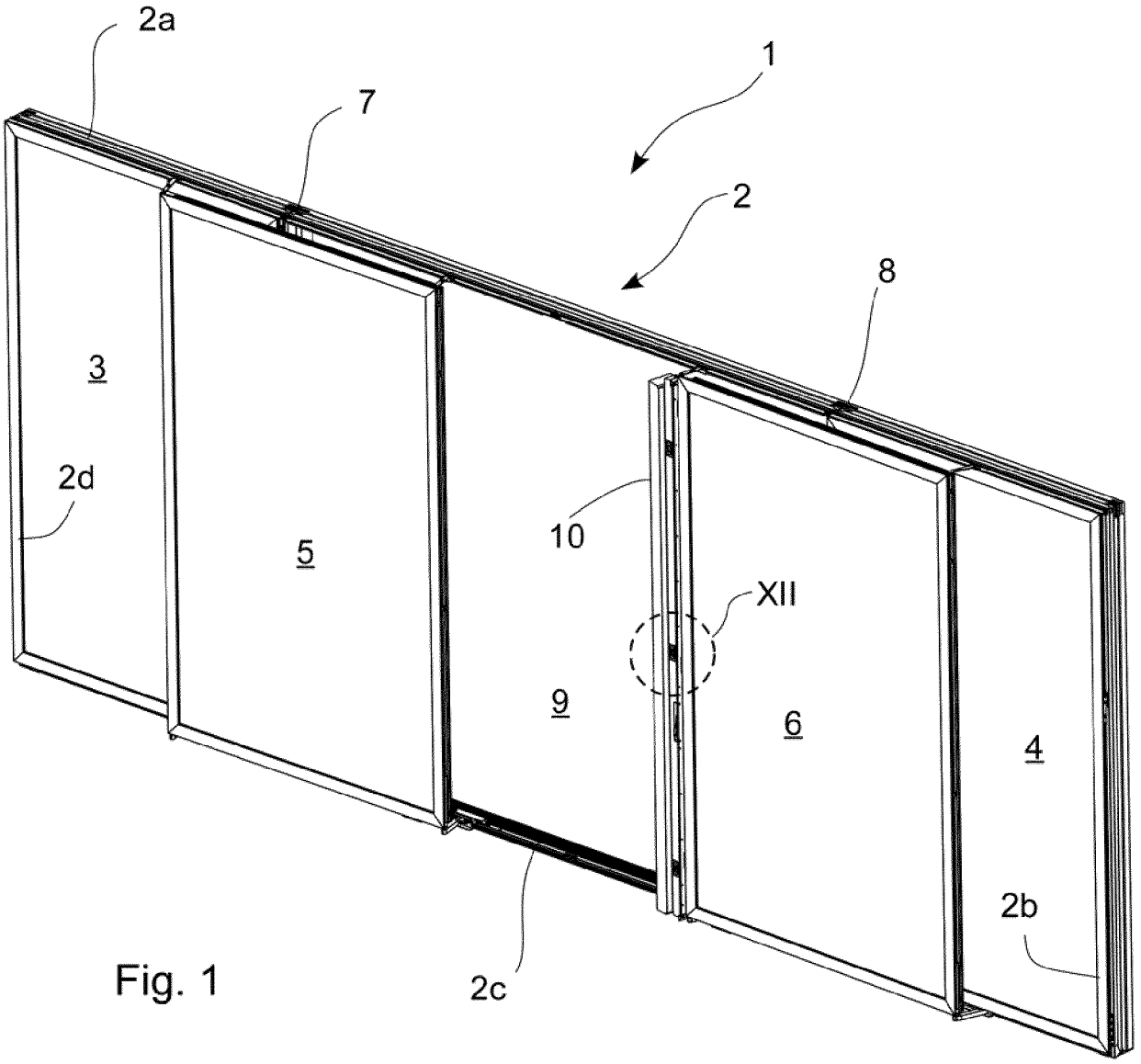


Fig. 1

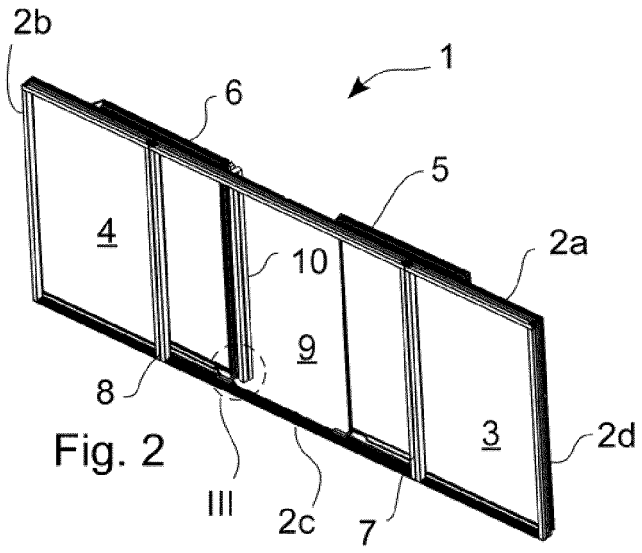
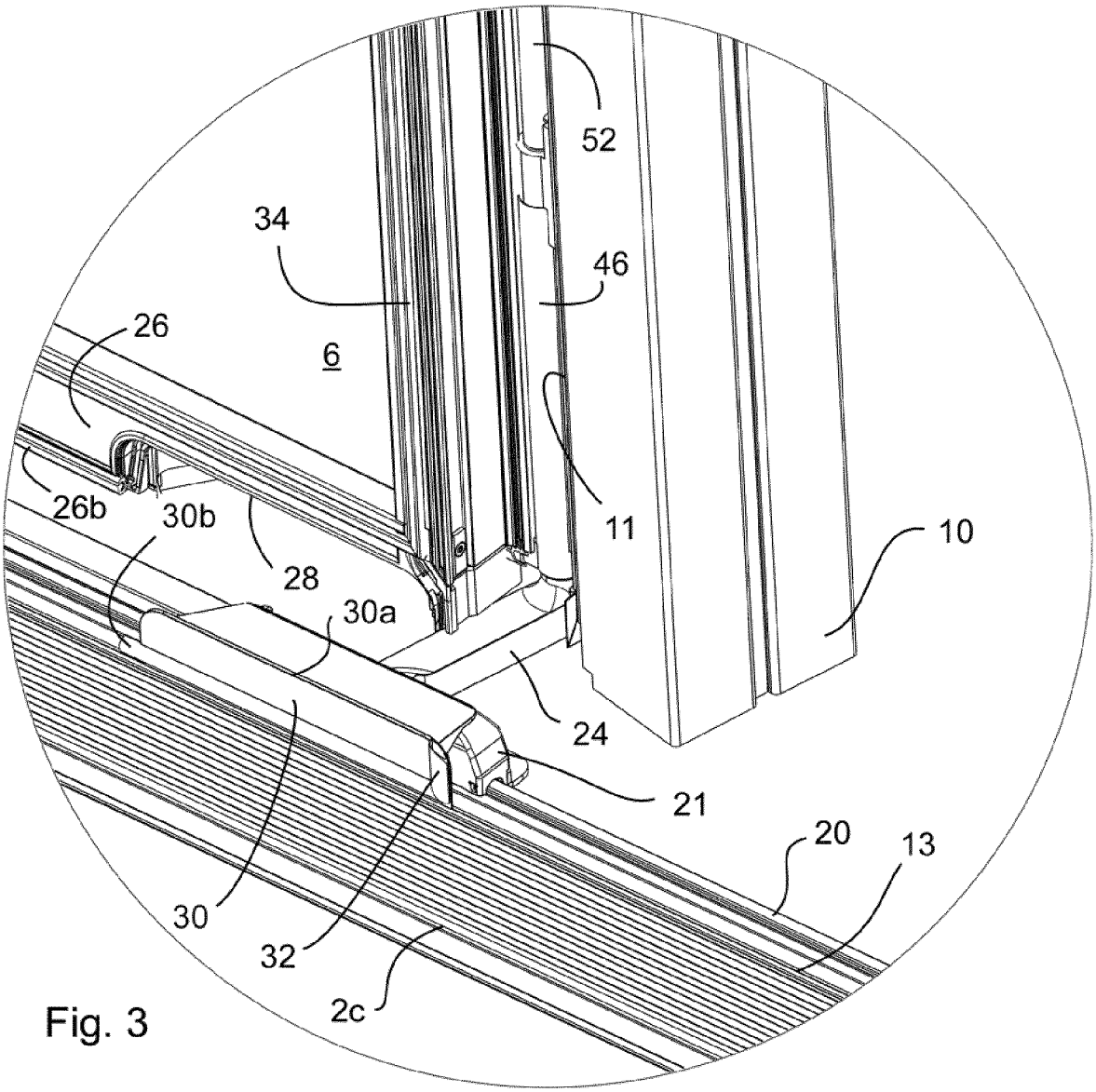

2b
1
6
5
4
10
2a
9
8
3
2d
III
2c
7

Fig. 2


52
34
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28
30a
24
21
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13
30
32
2c

Fig. 3

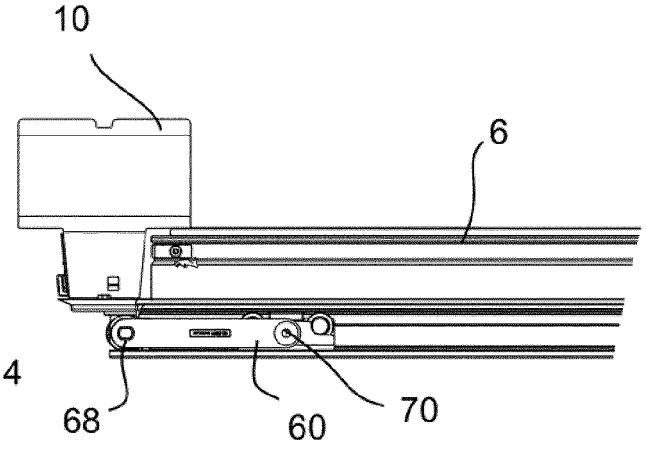

Fig. 4

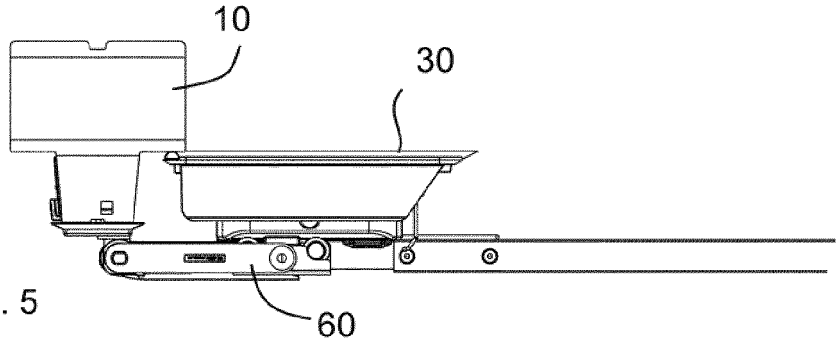

Fig. 5

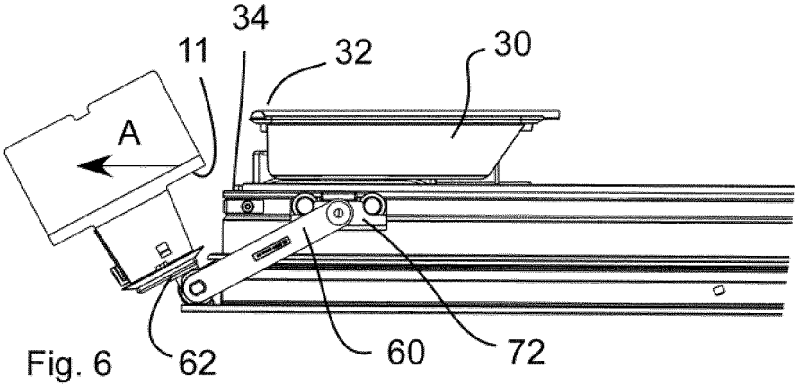

Fig. 6

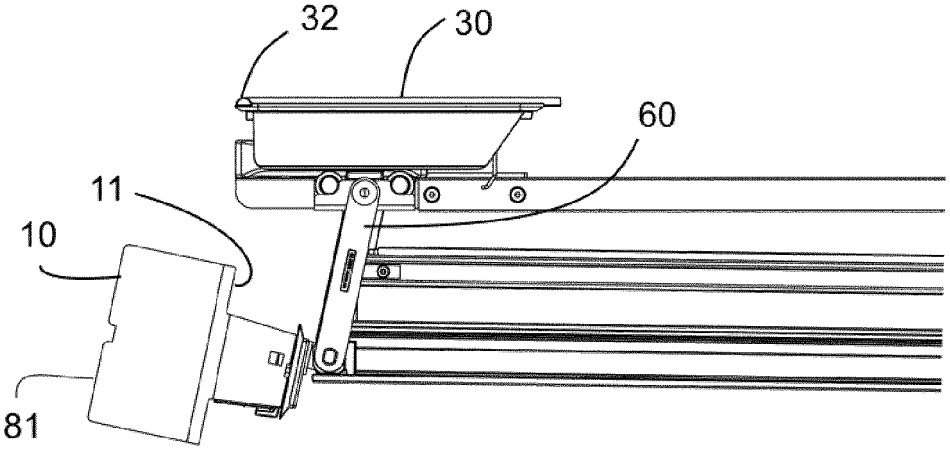

Fig. 7

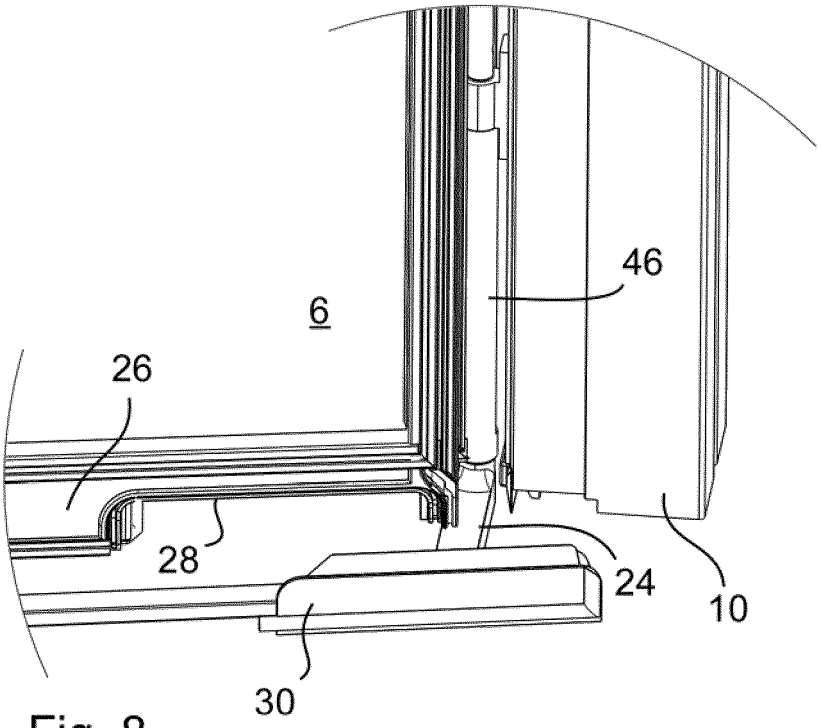

Fig. 8

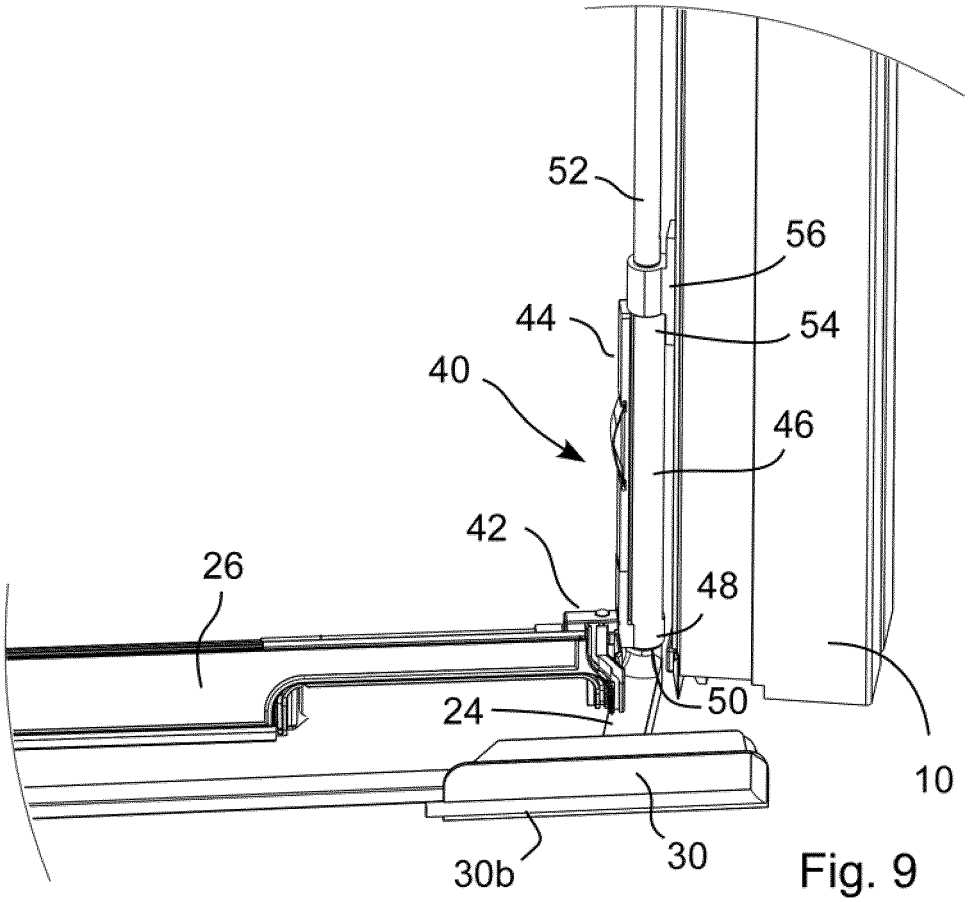

Fig. 9

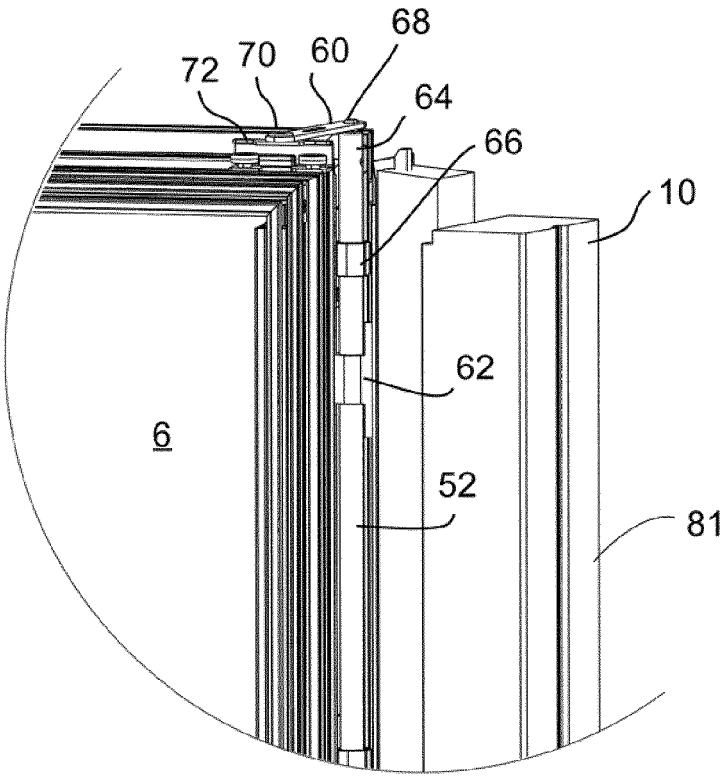

Fig. 10

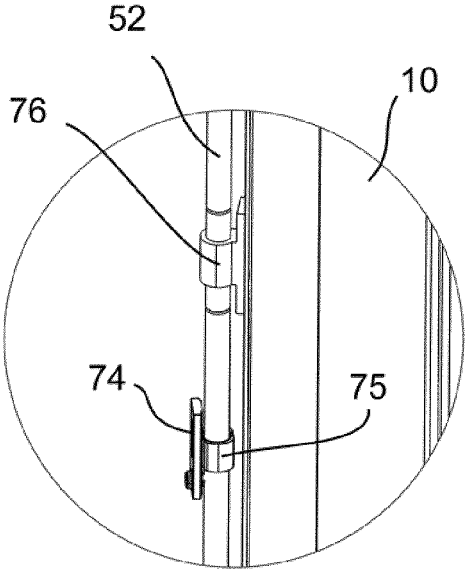

Fig. 11

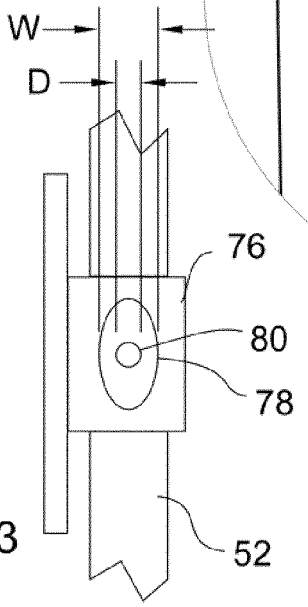

Fig. 13

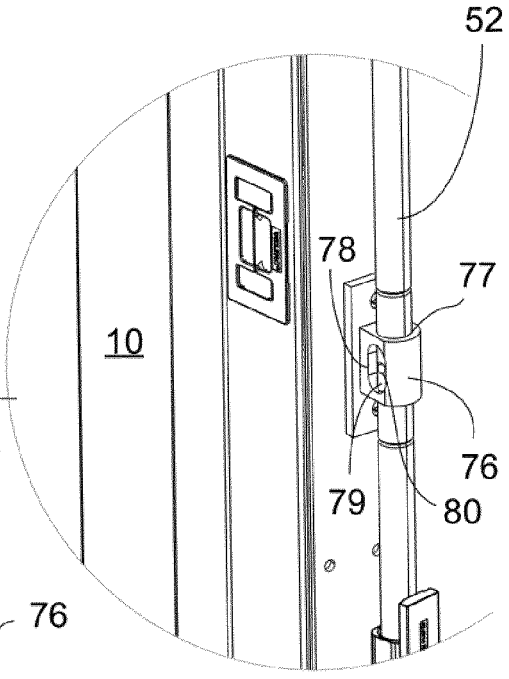

Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 17 20 3676

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 8 381 444 B1 (MCDONALD TIMOTHY J [US] ET AL) 26 February 2013 (2013-02-26) * column 4, line 12 - column 5, line 12; figures 1-4 *	1-15	INV. E05D15/10 E06B3/46 E06B1/52
A,D	EP 3 029 247 A1 (VKR HOLDING AS [DK]) 8 June 2016 (2016-06-08) * paragraphs [0036] - [0041]; figures 4-6,10,11 *	1-15	
A	US 2014/325912 A1 (HEADER GREGORY A [US] ET AL) 6 November 2014 (2014-11-06) * paragraphs [0050] - [0056]; figures 16,17,22-26 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

E05D
E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 March 2018	Hellberg, Jan

CATEGORY OF CITED DOCUMENTS

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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EPO FORM 1503 03.82 (P04C01)

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27-03-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 8381444 B1	26-02-2013	NONE	
EP 3029247 A1	08-06-2016	DK 201470766 A1	27-06-2016
		EP 3029247 A1	08-06-2016
US 2014325912 A1	06-11-2014	US 2014325912 A1	06-11-2014
		US 2016251886 A1	01-09-2016

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 2700598 C2 **[0013]**
- DE 3725617 A1 **[0013]**
- DE 3810944 A1 **[0013]**
- DE 8435367 U1 **[0013]**
- EP 90956 B1 **[0013]**
- EP 222091 B1 **[0013]**
- EP 619410 B1 **[0013]**
- EP 1645707 A1 **[0013]**
- EP 2216472 B1 **[0013]**
- EP 2685040 A2 **[0013]**
- EP 2690241 A1 **[0013]**
- EP 3029247 A **[0014] [0064]**
- US 2014325912 A1 **[0016]**