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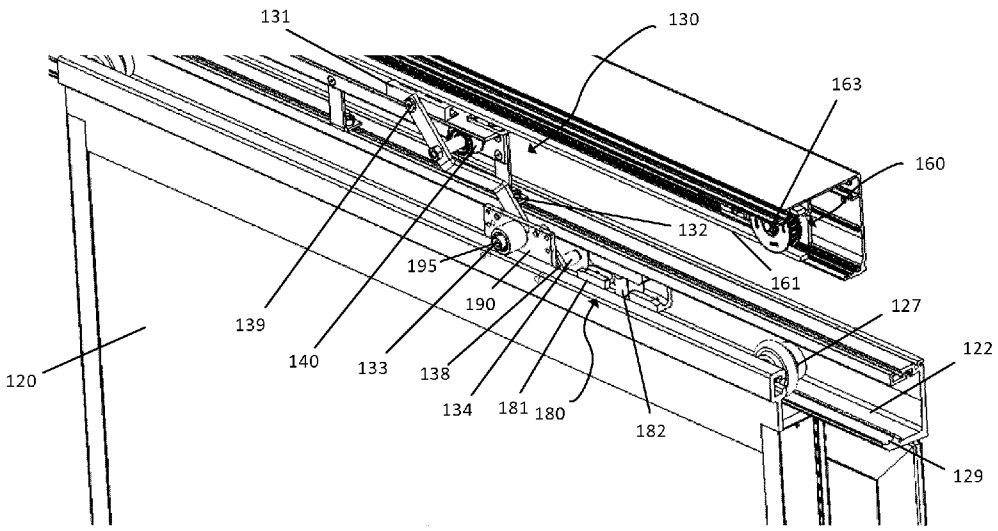

Fig. 2

(57) Abstract: A drive assembly (100) for driving a sliding door leaf (120) along a sliding door rail (122) defining an opening trajectory of the sliding door leaf (120), the drive assembly (100) comprising a drive unit (112) in driving connection with a drive member (131), a guiding arrangement (180) provided along the opening trajectory of the sliding door leaf (120) and a lever arm (130). The lever arm has one end (138) being provided with a guide element (134) for engagement with the guiding arrangement (180), an opposite end (139) being connected to the drive member (131), and a first intermediate portion (133) being pivotally connected to the sliding door leaf (120), whereby the lever arm (130) is movable along the opening trajectory of the sliding door leaf (120) during an opening cycle of the sliding door leaf (120).

WO 2019/179853 A1

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A DRIVE ASSEMBLY FOR A SLIDING DOOR ARRANGEMENT

Technical field

The present invention relates to a drive assembly for a sliding door arrangement for moving a sliding door leaf as well as sliding door assembly comprising said drive assembly.

Background

The use of automatic opening and closing of sliding doors is commonly known to facilitate access to buildings, rooms and other areas.

Conventional sliding doors are driven by a drive unit mounted at the door frame for driving a wagon along a rail via a driving belt. The wagon, in turn, is attached to the sliding door leaf, whereby the sliding door leaf is driven by the drive unit.

In some cases the sliding door may serve as a barrier which in many cases requires a heavier door and/or a closing mechanism which enables a larger closing force. For example, automatic sliding doors for an emergency room or an X-ray room may include a lead plate for shielding purposes, whereby the doors may weigh more than 400 kg.

For providing appropriate closing of the sliding door the horizontal moving sequence, when approaching the closing end position, normally changes to a three-dimensional motion in which the sliding door not only moves the last horizontal distance, but also moves downward, to close against the underlying ground or floor, as well as towards the frame. When opening the door the opposite motion is required.

Sliding doors configured to close in the above-described manner thus require a greater staring force in the opening cycle as the door actually needs to be lifted in the vertical direction. Standard drive unit are normally not dimensioned to provide such high force.

Notably, to simply use a reduction of the drive unit in order to provide a higher torque to the sliding door leaf would mean that the opening and closing movement of the sliding door leaf would be significantly slower.

Therefore an actuator is often used in conventional automatic sliding doors systems to provide assistance during the initial opening. After the door has accelerated from the closed position the torque of the main drive unit is enough to drive the door leaf in the horizontal direction, whereby the actuator is deactivated.

The provision of the actuator leads to a more costly, larger and complex drive assembly for a sliding door arrangement.

It would therefore be beneficial to provide a more simple solution still allowing for the sliding door to close and open appropriately.

Summary

An object of the present invention is therefore to provide a solution to the above-mentioned problem, reducing the disadvantages of prior art solutions.

An idea of the present invention is to provide a drive assembly for driving a sliding door leaf. The drive assembly allows for an initial high torque during the beginning of an opening cycle of the sliding door leaf without negatively impacting the opening and closing speed of the sliding door leaf. The drive assembly further allows for a reduction of the complexity of the associated drive assembly.

According to a first aspect a drive assembly for driving a sliding door leaf along a sliding door rail defining an opening trajectory of the sliding door leaf is provided. The drive assembly comprises a drive unit in driving connection with a drive member, a guiding arrangement provided along the opening trajectory of the sliding door leaf and a lever arm. The lever arm has a guide element for engagement with the guiding arrangement, an opposite end being connected to the drive member and a first intermediate portion being pivotally connected to the sliding door leaf. The lever arm is movable along the opening trajectory of the sliding door leaf during an opening cycle of the sliding door leaf.

The guiding element may be arranged to obstruct the guide element so as to cause the lever arm to pivot.

The lever arm may be caused to pivot between a closing position, in which the lever arm is tilted relative vertical axis, and an opening position, in which the lever arm is tilted in the opposite direction relative said vertical axis.

The drive assembly may further comprise a belt drive arrangement connecting the drive unit with the drive member. The drive member may be fixed to a belt of the belt drive arrangement.

The vertical distance between the intermediate portion and the guiding arrangement may preferably increase when the lever arm pivots between the opening position and the closing position.

The guiding arrangement comprises an engagement portion for engaging the guide element and a stop member for obstructing the guide element and causing the pivoting of the lever arm.

The engagement portion may be disposed at a distance from the stop member along the opening trajectory so as to form a recess adapted to receive the guiding member between the stop member and the engagement portion in the end of the opening cycle.

The stop member may be a vertically extending rolling element, whereby said vertically extending rolling element is adapted to be in rolling contact with the guide element upon obstruction of said guide element.

The guiding arrangement may be disposed along the opening trajectory of the sliding door leaf at a position such that the lever arm is urged to pivot in the beginning of the opening cycle of the sliding door leaf.

The guide element may be a horizontally extending rolling element.

A second guide element may be connected to a second intermediate portion of the lever arm for engagement with a guiding rail. The guiding rail may have an engagement portion disposed along the opening trajectory at a position such that the switching between the closed and opened position of lever arm causes the engagement between the second guide element and the guiding rail in the beginning of the opening cycle.

The second guide element may be arranged for engagement with the guiding rail so as to apply a contact force in the direction of the opposite end through the lever arm.

The engagement portion may comprise a protrusion, whereby the protrusion extends upwards in a vertical direction.

The drive assembly may further comprise a console for pivotally connecting the lever arm to the sliding door leaf, said console further comprising a pair of stop elements each arranged on a respective side of the lever arm so as to prevent pivoting beyond the opening and closing position of the lever arm respectively.

Preferably, the lever arm has a torque ratio between 4:1 and 5:1.

According to a second aspect, a sliding door arrangement is provided comprising a sliding door leaf and a drive assembly according to the first aspect presented above.

The sliding door arrangement may comprise the sliding door rail, whereby said sliding door rail is for engagement with a set of wheels provided on the sliding door

leaf. The sliding door rail may comprise a set of sunken portions disposed along said sliding door rail in positions such that the sunken portions are configured to receive the wheels in the end of the opening cycle of sliding door leaf.

Brief description of the drawings

Embodiments of the invention will be described in the following; reference being made appended drawings which illustrate non-limiting examples of how the inventive concept can be reduced into practice.

Fig. 1 shows a schematic view of a sliding door arrangement comprising a drive assembly according to an embodiment of the present invention;

Fig. 2 shows a schematic perspective view of a drive assembly according to an embodiment of the present invention.

Fig. 3a shows a schematic view of a lever arm and guiding arrangement of a drive assembly according to an embodiment of the present invention, wherein the lever arm is a closed position.

Fig. 3b shows a schematic view of a lever arm and guiding arrangement of a drive assembly according to an embodiment of the present invention, wherein the lever arm is in an open position.

Detailed description of embodiments

An example of a drive assembly will be described in the following. With reference to Fig. 1, a sliding door arrangement comprising a drive assembly 100 for driving a sliding door leaf 120 is presented. The sliding door leaf 120 is driven along a sliding door rail 122 fixed to a door frame 110 by a drive unit 112.

The door leaf 120 may be a door constructed by wood, metal, plastic, glass or other suitable material. The door may also be a fire resistant door having a fire resistant core made of any suitable material generally known in the art. Fire resistant doors are arranged to prevent or substantially delay the transfer of thermal energy, i.e. heat, from one side of the door to another side and due to its construction these doors are often comparatively heavy.

Further referring to Fig. 1 the drive assembly 100 comprises the drive unit 112 being in driving connection with a drive member 131. The drive unit 112 may be of any conventional type. Typically, the drive unit is a compact electric motor providing the necessary torque to move the sliding door leaf 120 horizontally. According to the present example a belt drive arrangement 160 connects the drive unit 112 with the drive

member 131. Advantageously, the drive unit 112 is adapted to be connected to a door frame 110 of the sliding door assembly, or even mounted within the upper part of the door frame 110.

Due to the weight of the sliding door leaf 120 as well as the friction in the contact between the sliding door leaf 120 and/or the floor or frame 110, a relatively large torque is required to initiate the movement of the sliding door leaf 120 from the closed position, i.e. when the door leaf 120 is urged to move to the left in Fig. 1. Normally, such a large torque cannot be provided with a conventional drive unit without severely reducing the speed of which the sliding leaf 120 can move between an opened and closed position.

With reference to Fig. 2, the door leaf 120 is suspended to the sliding door rail 122 by means of a set of wheels 127 attached to said door leaf 120, i.e. the sliding door leaf 120 is provided with said set of wheels 127. Preferably, the set of wheels are low friction wheels. The set of wheels 127 allows the sliding door leaf 120 to move into a closed and open position along the horizontal sliding door rail 122.

Several applications for an automated sliding door arrangement requires the sliding door leaf to serve as a barrier minimizing any transfer of mediums between the rooms separated by the door arrangement. For such applications the sliding door leaf 120 may be provided with sealings adapted to be pushed against the door frame 110 and/or the ground when the sliding door leaf 120 is in a closed position.

To enable the provision of the additional torque without requiring an additional actuator the drive assembly 100 comprises a lever arm 130, see e.g. Fig. 2. The lever arm 130 has an end 138 provided with a guide element 134, preferably in the form of a horizontally extending rolling element. Said horizontally extending rolling element 134 may preferably have a rolling member in a low friction material mounted in a bearing so as to reduce the friction due to contact forces applied on said rolling member. The lever arm 130 is provided as an elongated arm member 132.

The lever arm 130 further has a first intermediate portion 133 being pivotally connected to the sliding door leaf 120. Preferably, the first intermediate portion may be pivotally connected to the sliding door leaf 120 via a console 190 attached to the sliding door leaf 120.

The lever arm 130 further comprises an opposite end 139 being connected to the drive member 131.

Again referencing Fig. 2, lever arm 130 is pivotally connected to the sliding door leaf 120 at the first intermediate portion 133 via a pivot joint 195, which may be

provided on a console 190. Thus, the lever arm 130 is movable along the opening trajectory of the sliding door leaf 120.

Preferably the lever arm 130 has a torque ratio of approximately between 4:1 and 5:1 in relation to the drive unit 112. With advantage, the torque ratio may be approximately 4,5:1, or even more advantageously approximately 4,55:1. The torque ratio may be chosen by altering the length of the lever arm 130 or the position of the pivot joint 195. With the aforementioned torque ratios the lever arm may be able to support and move sliding door leafs with a weight up to 200 kg.

According to the present example, referring to Fig. 1 and 2, the drive member 131 is fixed to a belt 161 of the belt drive arrangement 160. The belt drive arrangement 160 further comprises a set of belt drive members 162, 163 i.e. a set of wheels for driving said belt 161. The first wheel 162 is directly connected to the drive unit 112 (see Fig. 1), and the second wheel 163 is connected to said first wheel 162 via the endless belt 161. The distance between the first and second wheels 162, 163 corresponds to the maximum horizontal distance which the sliding door leaf 120 may move. The second wheel 163 may e.g. be connected to a bracket 150 fixed to the door frame 110. The belt 161 may be a synchronous drive belt, whereby the wheels 162, 163 may be cogged wheels. The drive member 131 may for example be a clamp being fixedly connected to the belt161, whereby the lever arm 130 will provide the additional force for moving the sliding door leaf 120 when the drive unit 112 is activated.

To provide sufficient sealing when a sliding door assembly is in a closed position the weight of the sliding door leaf 120 is usually utilized in order to push the door leaf 120 downwards towards a sealing member such as the ground or floor of the room or the frame 110. The contact with the sealing member leads to an increased friction working against the opening movement of the sliding door leaf 120.

Referring to Fig. 2, the guide element 134 is provided on the end 138 of the lever arm 130. The guide element 134, which may be in the form of horizontally extending rolling element, is for engagement with a guiding arrangement 180.

The guiding arrangement 180 is provided along the opening trajectory of the sliding door leaf 120. Accordingly, the guiding arrangement may be provided along a movement trajectory of the lever arm 130, due to the lever arm 130 being connected to the sliding door leaf 120, substantially parallel to the opening trajectory of the sliding door leaf 120. The guiding arrangement 180 is adapted to impinge on the movement of the lever arm 130 along said movement trajectory. Preferably, the guiding arrangement

180 is adapted to impinge on said movement by means of engagement with the guide element 134 of the lever arm 130.

The opening trajectory is hereinafter defined by the movement of the sliding door leaf 120 during an opening cycle of said sliding door leaf 120. An opening cycle is defined by the sliding door leaf moving from a closed position to an open position and back to said closing position, i.e. the entire cycle of opening and thereafter closing the door.

As will be further explained in the following the provision of the lever arm 130 allows for a more compact drive assembly 100 which does not require any additional actuator to enable the initiation of the opening cycle of the sliding door leaf 120. Furthermore, it allows for a more cost-efficient solution.

The drive assembly accordingly comprises the guiding arrangement 180 provided along the opening trajectory of the sliding door leaf 120, whereby the guiding arrangement 180 is adapted to direct the movement of the lever arm 130 so as to tilt the lever arm 130 about the pivot joint 195 upon intersection with said guiding arrangement 180. Accordingly, the guiding arrangement 180 is arranged to obstruct the guide element 134 so as to cause the lever arm 130 to pivot. The guide element 134 causes the lever arm to pivot along the opening trajectory of the sliding door leaf 120.

This pivoting of the lever arm 130 provides additional torque to the sliding door leaf 120 via the additional torque provided by the connection between the drive unit and said lever arm. Thus additional torque can be provided to the sliding door leaf without requiring a larger drive unit, or reduction gearings resulting in a more cost-efficient and less complex drive assembly.

The guiding arrangement 180 is disposed along the opening trajectory at a position allowing for additional torque in the beginning of an opening cycle of the sliding door leaf 120. By temporary tilting of the lever arm 130 while the pivot joint is temporarily stationary, the lever arm 130 provides the required torque to lift the sliding door leaf 120. Thus, the guiding arrangement 180 is disposed along the opening trajectory of the sliding door leaf 120 at a position such that the lever arm is urged to pivot in the beginning of an opening cycle of the sliding door leaf 120.

Conventional sliding door rails are usually provided with sunken portions for receiving the wheels attached to the sliding door leaf in the closed position of the sliding door leaf. Thereby, the sliding door leaf is lowered so as to seal properly in the closed position. In a sliding door arrangement with such a sliding door rail, the lever arm enables provision of the torque necessary to push the wheels attached to the sliding door

leaf upwards from the sunken portions, thereby causing the lifting of the sliding door leaf.

The provision of the guiding arrangement 180 prevents the lever arm 130 to move in a straight horizontal position the opening cycle (i.e. to the right in Fig. 2) of the sliding door leaf 120. Thus, the guiding arrangement 180 will induce a pushing force to the sliding door leaf 120 from the drive member 131 via the lever arm 130 which provides additional torque to the sliding door leaf 120 compared to a conventional drive assembly.

The lever arm 130 is caused to pivot between a closing position and an opening position. The closing position, in which the lever arm 130 is tilted relative a vertical axis, corresponds to a closing cycle of the sliding door leaf 120. The opening position, in which the lever arm 130 is tilted in the opposite direction relative said vertical axis, corresponds to an opening cycle of the sliding door leaf 120. The tilting of the lever arm 130 while the pivot joint is temporarily stationary in the guiding arrangement 180 in the beginning of the opening cycle, the lever arm provides the required torque to lift the sliding door leaf in the beginning of said opening cycle.

Hence, a high starting force can be provided while the door leaf 120 can be run in a high speed during the greater part of the opening cycle without requiring an additional actuator.

The guiding arrangement 180 and the lever arm 130 is further shown in Fig. 3a and Fig. 3b. Fig. 3a discloses the lever arm in a closing position while Fig. 3b discloses said lever arm in an opening position.

With reference to said figures, the guiding arrangement 181 comprises an engagement portion 181 for engaging the guide element 134 and a stop member 182 for obstructing the guide element 134 and causing the pivoting of the lever arm 130.

The stop member 182 causes the lever arm 130 to change its inclination from a negative tilted inclination to a positive tilted inclination via an intermediate upright vertical position, causing the lever arm 130 to pivot to its closing position.

The stop member 182 is further for allowing the guide element 134 to climb in a vertical, upward direction along the surface of said stop member 182. The climbing occurs when pivoting of the lever arm 130 from the closing position is initiated by means of the drive member 131, i.e. when the drive member 131 begins moving (from right to left as depicted in Fig. 3a-b). Thus, the stop member 182 is arranged to temporarily prevent horizontal movement of the guide element 134 as the lever arm 130 pivots from the closed position towards the open position. The contact between the stop

member 182 and the guiding element 134 provides a pivoting point for the lever arm 130, whereby the additional torque is provided to the sliding door leaf 120 via the lever arm 130.

The pivoting of the lever arm in the end of the opening cycle provided by the stop member also allows for a braking effect on the sliding door leaf. When the wheels attached to the sliding door leaf reaches the sunken portions, which often are provided with a ramp, a sudden downward movement of the sliding door leaf occurs, which may cause the sliding door leaf to collide with the floor with its entire weight. This is counteracted by the movement and obstruction of the lever arm, by means of the stop member, providing a braking torque. The lever arm thus allows for a smoother and more controlled closing of the sliding door leaf.

As seen in Fig. 3a-b, the vertical distance between the first intermediate portion 133 and the guiding arrangement 180 increases when the lever arm 130 pivots between the opening position and closing position. Thus, the lever arm 130 provides a vertical and upwards directed force in the switching from the closing position to the opening position. This enables lifting of the sliding door leaf of the ground which reduces the friction and required torque for initiating the opening cycle.

Said lifting of the sliding door leaf 120 may at least partly be provided by means of the aforementioned climbing of the guide element 134 along the stop member 181.

The engagement portion 181 may preferably be disposed along the opening trajectory of the sliding door leaf 120 at a position such that the guiding member 134 comes into engagement with the engaging portion 181 of the guiding arrangement in the end of the opening cycle. Consequently, the stop member 182 may preferably be disposed along the opening trajectory of the sliding door leaf 120 at a position such that the guiding member 134 is obstructed in the end of the of the opening cycle, i.e. after the guide element 134 comes into engagement with the engagement portion 181.

Sliding door leafs are often heavy, especially sliding door leafs for hermetic sliding door systems. Due to the guiding arrangement 180, i.e. the engagement portion 181, only being in engagement with the guide element 134 in the end of the opening cycle, the guide element 134 is not subjected to load associated with the weight of the sliding door leaf 120 during the entire opening cycle. Instead, the load associated with the weight of sliding door leaf 120 is taken up by the connection between the lever arm and the sliding door leaf 120 and/or the set of wheels 127 provided on the door leaf.

The guiding element 134 is thus only subject to load when being in engagement with the guiding arrangement 180, i.e. when the extra load is required in the opening cycle.

The reduced load on the guide element 134 increases the durability of the guide element 134. The reduced load on the guide element 134 increases the robustness and durability of the entire drive assembly due to the reduced load on the moving parts granting the functionality of said drive assembly, i.e. the guide element 134.

The engagement portion is disposed at a distance from the stop member 182 along the opening trajectory so as to form a recess adapted to receive the guide element 134 between the stop member 182 and the engagement portion 181 in the closing position.

Preferably, said recess is adapted to direct the movement of the lever arm 130 so as to lift the pivot joint 137 of said lever arm 130 when the guide element 134 abuts to said recess in the beginning of the opening cycle.

The recess temporarily prevents the guide element 134 to move in a straight horizontal direction (to the left) along the opening trajectory of the sliding door leaf 120 during the opening cycle of the door leaf 120 before the guide element 134 manages to climb on top of the engagement portion 181. Thus, further lifting of the sliding door leaf 120 is provided due to the guide element 134 climbing from the recess towards and on top of the engagement portion 181.

At the end of the opening cycle, the stop member 182 will come into contact with the guide element 134, preferably in the form a horizontal rolling element, which is thus prevented from moving further to the right in Fig. 3. However, as the drive unit 112 may continue to pull the lever arm to the right an additional lowering of the sliding door leaf 120 is accomplished for improving the closing action due to the recess receiving the guide element 134.

The recess serves to increase the sealing force, i.e. the force pushing the sliding door leaf 120 downwards towards its associated sealing member. Hence, a tighter sealing of the sliding door leaf 120 in a closed position can be provided by the drive assembly in a less complex and more cost-efficient manner.

The sunken portions may further be arranged to guide the wheels towards the door frame for moving the sliding door leaf inwardly towards the door frame in the end of the opening cycle of the sliding door leaf. This enhances the sealing properties of the sliding door arrangement.

The inwardly facing motion causes undesirable bending load and increased wear on a conventional sliding door lever arm due to the lever arm being fixed in its range of motion.

To counteract the bending loads and increased wear, the stop member 182 is preferably a vertically extending rolling element which is adapted to be in rolling contact with the guide element 134 upon obstruction of said guide element 134. This allows for the entire lever arm 130 to move together with the sliding door leaf 120 inwardly towards the frame without being subjected to the aforementioned undesirable bending load and increased wear. Instead, the guide element 134 may roll along the stop member 182 inwardly towards the frame 110 without high friction or peak forces.

Worded differently, the stop member 182 being a vertically extending rolling element enables tighter sealing between the frame and the sliding door leaf while counteracting the load and wear to the entire lever arrangement associated with the inward movement of the door leaf towards the frame.

Further, the rolling contact considerably reduces the general friction between the guide element and the stop member upon contact, especially if both are in the form of rolling elements i.e. the stop member 181 being a horizontally extending rolling element and the guide element being a vertically extending rolling element. The rolling contact between the guide element and the stop member reduces the wear of said guide element and stop member and consequently increases the durability of the drive assembly.

The stop member and the recess causes the lever arm 130 to change its inclination from a negative tilted inclination to a positive tilted inclination via an intermediate upright vertical position, causing heightening of the position of the pivot joint 195 in the process, whereby the lifting occurs

Again referring to Fig. 3a-b, a second guide element 221 is connected to a second intermediate portion 140 of the lever arm 130 for engagement with a guiding rail 230. The second guide element may a wheel, preferably in a low friction material. The guiding rail 230 has an engagement portion 231 disposed along the opening trajectory at a position such that the switching between the closed and opened position of lever arm 130 causes the engagement between the second guide element 221 and the guiding rail 230 in the beginning of the opening cycle.

Said guiding rail 230 allows for a more controlled manner to switch between the open and closing position of the lever arm 130. By means of the guiding rail 230 the swinging of the lever arm 130 is controlled whereby the movement of the sliding door

leaf 120 becomes more stable and more predictable. This is due to the angle of the lever arm 130 being held substantially constant until the drive member 131 changes direction. Accordingly, the guiding rail may be arranged so as to engage the second guide element 221 in the beginning of the opening cycle and disengage said second guide element 221 in the end of said opening cycle.

The guiding rail 121 is preferably downward facing, i.e. said guiding rail 121 is arranged to face the opposite end 138. The guide element 134 is arranged for engagement with the guiding rail 121 so as to apply a contact force in the direction of the opposite end 139 through the lever arm 130.

The downward facing orientation of the guiding rail 121 reduces the load on the second guide element 221 while allowing for said controlled movement of the sliding door leaf 120 since second guide element 221 does not have to carry load associated with the sliding door leaf 120. The reduced load on the second guide element 221 reduces the wear and increases the durability of the drive assembly.

To avoid the second guide element 221 skipping on top of the guiding rail 230 due to for example large impacts or human intervention, the engagement portion 231 comprises a protrusion, whereby the protrusion extends upwards in a vertical direction. Thus, the risk for the second guide element not coming into engagement with the guiding arrangement 180 due to impacts or human intervention is reduced.

Preferably the guiding arrangement 180 and the guiding rail 230 are attached to the door frame. However, as the skilled person recognizes it would also be possible to mount them to a wall or a roof in the vicinity of the drive assembly as long as they are positioned so as to come into engagement with the guiding members of the lever arm in the desired manner.

In Fig. 3a-b the console 190 for pivotally connecting the lever arm 130 to the sliding door leaf 120 is more closely depicted. The console 190 is attached to the sliding door leaf 120 and further comprises a pivot bearing in the pivot joint 195 to which the first intermediate portion 133 is connected. The console 190 is accordingly movable together with the sliding door leaf 120 along the opening trajectory of the sliding door leaf 120.

The console further comprising a pair of stop elements 191 each arranged on a respective side of the lever arm 130 so as to prevent pivoting beyond the opening and closing position of the lever arm 130 respectively.

The pair of stop elements 191 may preferably be in form of horizontally extending fastening element, for example screws, extending horizontally through the console 190.

According to an aspect of the invention a sliding door arrangement is provided. The sliding door leaf comprises a sliding door leaf 120 and a drive assembly as described above with reference to Fig. 1-3.

The sliding door arrangement may comprise the sliding door rail 122, whereby the sliding door rail 122 is for engagement with a set wheels 127 provided on the sliding door leaf 120. The sliding door rail 122 comprises a set of sunken portions 129 disposed along said sliding door rail 122 in positions such that the sunken portions 129 are configured to receive the wheels 127 in the end of the opening cycle of the sliding door leaf.

Due to the sunken portions 129 the sliding door rail 122 may receive the load associated with the weight of the sliding door leaf 120 in the closed position instead of the lever arm 130 and/or the guiding arrangement 180. The reduced load on the lever arm 130 and/or the guiding arrangement 180 of the drive assembly reduces the wear on the first and/or second guide element and the durability of the drive assembly in whole.

The sliding door arrangement may comprise a door frame 110. The door frame 110 may form a door opening, the sliding door leaf 120 being arranged to cover said door opening when being in a closed position.

The sunken portions 129 of the sliding door rail 122 may be arranged to guide the set of wheels 127 towards the door frame 110 for moving the sliding door leaf 120 inwardly towards the door frame 110 in the end of the opening cycle of the sliding door leaf 120. The set of sunken portions 129 may be provided with an inclined phase for guiding said set of wheels 127 in the aforementioned direction.

It should be appreciated that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the description is only illustrative and changes may be made in detail, especially in matters of shape, size and arrangement of parts within the scope of the invention to the full extent indicated by the appended claims

CLAIMS

1. A drive assembly (100) for driving a sliding door leaf (120) along a sliding door rail (122) defining an opening trajectory of the sliding door leaf (120), the drive assembly (100) comprising

a drive unit (112) in driving connection with a drive member (131);

a guiding arrangement (180) provided along the opening trajectory of the sliding door leaf (120); and

a lever arm (130) having one end (138) provided with a guide element (134) for engagement with the guiding arrangement (180), an opposite end (139) being connected to the drive member (131), and a first intermediate portion (133) being pivotally connected to the sliding door leaf (120), whereby the lever arm (130) is movable along the opening trajectory of the sliding door leaf (120) during an opening cycle of the sliding door leaf (120).

2. The drive assembly (100) according to claim 1, whereby the guiding arrangement (180) is arranged to obstruct the guide element (134) so as to cause the lever arm (130) to pivot.

3. The drive assembly (100) according to claim 2, wherein the lever arm (130) is caused to pivot between a closing position, in which the lever arm (130) is tilted relative a vertical axis, and an opening position, in which the lever arm (130) is tilted in the opposite direction relative said vertical axis.

4. The drive assembly (100) according to any one of the preceding claims, further comprising a belt drive arrangement (160) connecting the drive unit (112) with the drive member (131).

5. The drive assembly (100) according to claim 4, the drive member (131) being fixed to a belt (161) of the belt drive arrangement (160).

6. The drive assembly (100) according to any of claim 3 to 5, wherein the vertical distance between the first intermediate portion (133) and the guiding arrangement (180) increases when the lever arm (130) pivots between the opening position and the closing position.

7. The drive assembly (100) according to any one of claim 2 to 6, wherein the guiding arrangement (180) comprises an engagement portion (181) for engaging the guide element (134) and a stop member (182) for obstructing the guide element (134) and causing the pivoting of the lever arm (130).

8. The drive assembly (100) according to claim 7, wherein the engagement portion (181) is disposed at a distance from the stop member (182) along the opening trajectory so as to form a recess adapted to receive the guiding member (134) between the stop member (182) and the engagement portion (181) in the end of the opening cycle.

9. The drive assembly (100) according to claim 7 or 8, wherein the stop member (182) is a vertically extending rolling element, whereby said vertically extending rolling element is adapted to be in rolling contact with the guide element (134) upon obstruction of said guide element (134).

10. The drive assembly (100) according to any one of claim 2 to 9, wherein the guiding arrangement is disposed along the opening trajectory of the sliding door leaf (120) at a position such that the lever arm (130) is urged to pivot in the beginning of the opening cycle of the sliding door leaf (120).

11. The drive assembly (100) according to any one of the preceding claims, wherein the guide element (134) is a horizontally extending rolling element.

12. The drive assembly (100) according to any one of claim 3 to 11, wherein a second guide element (221) is connected to a second intermediate portion (140) of the lever arm (130) for engagement with a guiding rail (230), said guiding rail (230) having an engagement portion (231) disposed along the opening trajectory at a position such that the switching between the closed and opened position of lever arm (130) causes the engagement between the second guide element (221) and the guiding rail (230) in the beginning of the opening cycle.

13. The drive assembly (100) according to claim 12, whereby the second guide element (221) is arranged for engagement with the guiding rail (230) so as to apply a contact force in the direction of the opposite end (139) through the lever arm (130).

14. The drive assembly (100) according to claim 13, whereby the engagement portion (231) comprises a protrusion, whereby the protrusion extends upwards in a vertical direction.

15. The drive assembly (100) according to any one of claim 3 to 14, further comprising a console (190) for pivotally connecting the lever arm (130) to the sliding door leaf (120), said console further comprising a pair of stop elements (191) each arranged on a respective side of the lever arm (130) so as to prevent pivoting beyond the opening and closing position of the lever arm (130) respectively.

16. A sliding door arrangement comprising a sliding door leaf (120) and a drive assembly (100) according to any of the claims 1-15.

17. The sliding door arrangement according to claim 16, wherein the sliding door arrangement comprises the sliding door rail (122), whereby said sliding door rail (122) is for engagement with a set of wheels (127) provided on the sliding door leaf (120), whereby the sliding door rail (122) comprises a set of sunken portions (129) disposed along said sliding door rail (122) in positions such that the sunken portions (129) are configured to receive the wheels (127) in the end of the opening cycle of the sliding door leaf (120).

18. The sliding door arrangement according to claim 17, further comprising a door frame (110), whereby the set of sunken portions (129) of the sliding door rail (122) are arranged to guide the set of wheels (127) towards the door frame (110) for moving the sliding door leaf (120) towards the door frame (110) in the end of the opening cycle of the sliding door leaf (120).

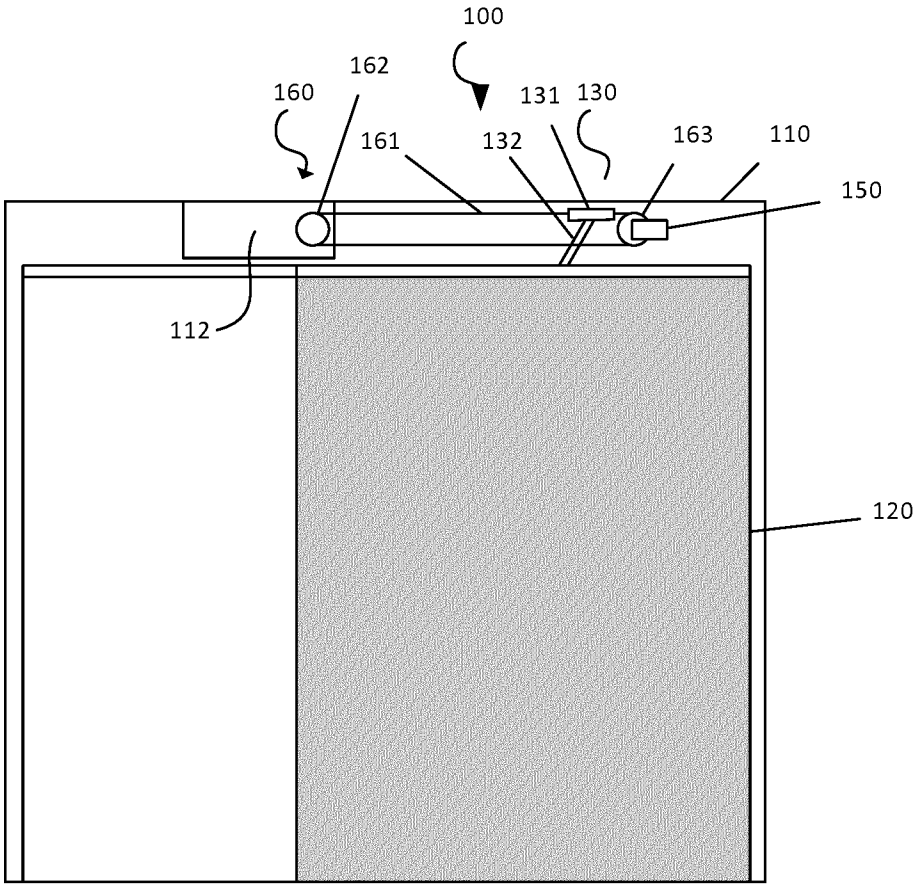
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Fig. 1

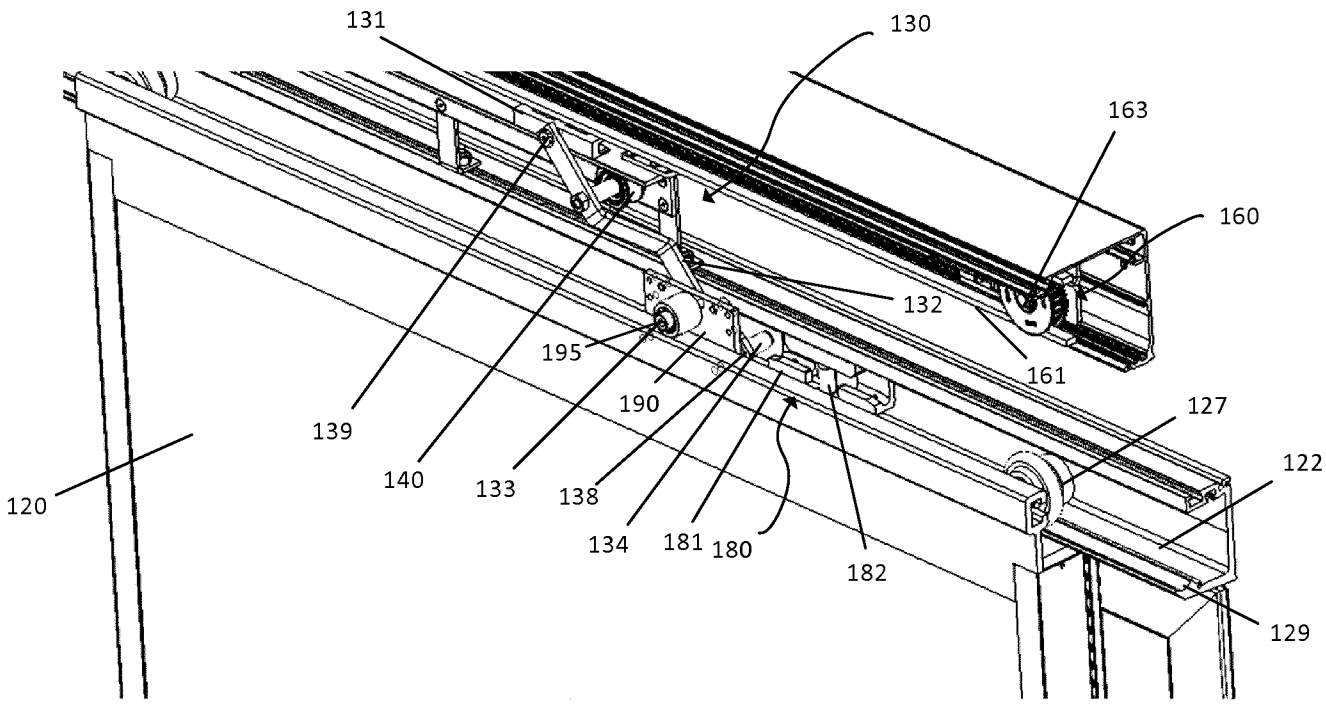
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Fig. 2

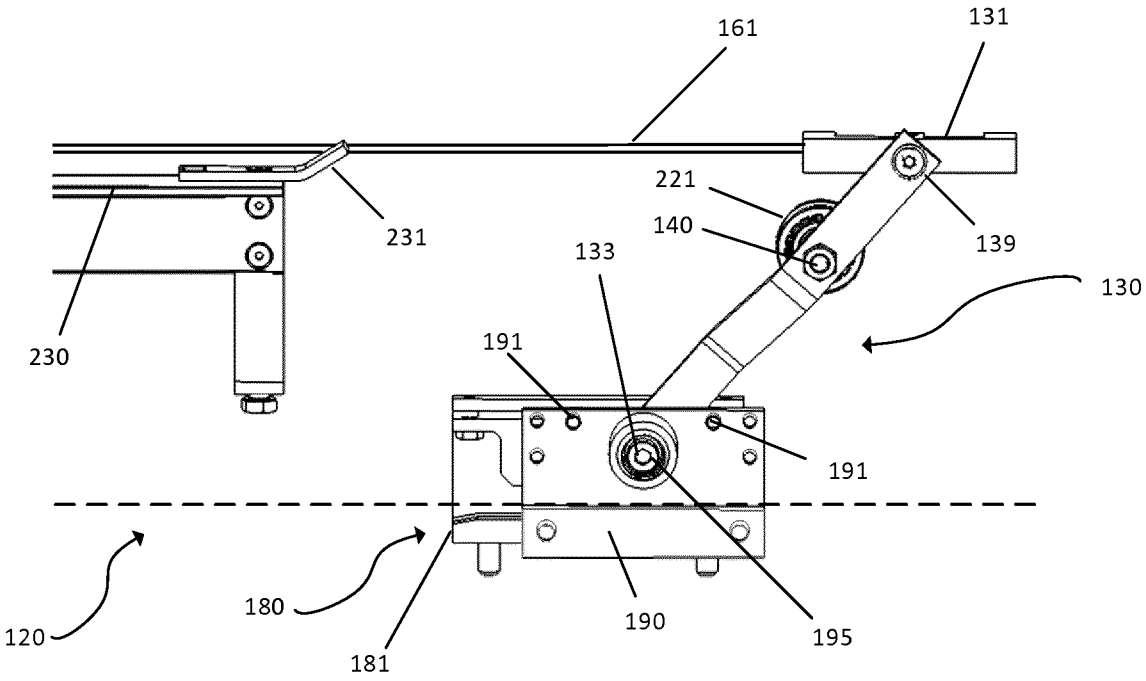
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Fig. 3a

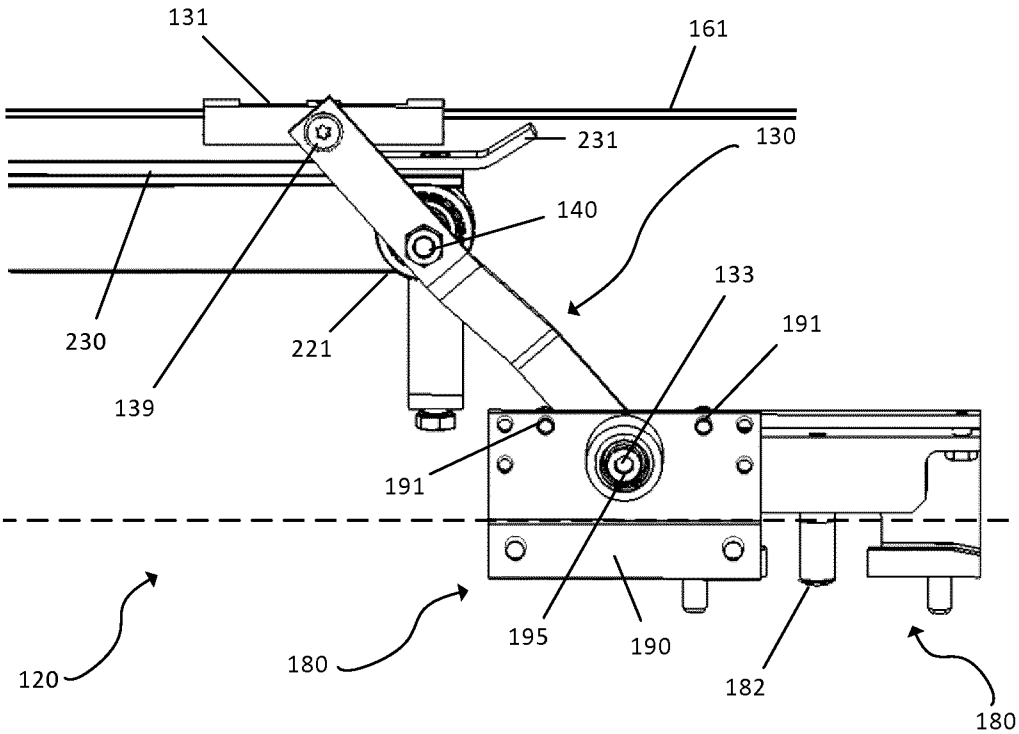
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Fig. 3b

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/056326

A. CLASSIFICATION OF SUBJECT MATTER
INV. E05D15/56 E05F15/643 E05F15/646
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E05D E05F

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	BE 1 007 862 A3 (VANDERWEEEN BENOIT [BE]) 7 November 1995 (1995-11-07) page 4, line 16 - page 7, line 35; figures 1-5	1-11, 15-18 12-14
A	GB 1 572 638 A (WATKINS C; WATKINS S) 30 July 1980 (1980-07-30) page 2, line 2 - page 3, line 22; figures 1-3	1-18
A	DE 11 62 718 B (OTTO STERKEL HOLZINDUSTRIE UND) 6 February 1964 (1964-02-06) column 3, line 22 - column 5, line 51	1-18

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
4 June 2019	14/06/2019

Name and mailing address of the ISA/	Authorized officer
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1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2019/056326

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
BE 1007862 A3	07-11-1995	NONE	
GB 1572638 A	30-07-1980	NONE	
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