Guiding device, carriage and running rail

The invention relates to a guiding device for a sliding element, particularly a sliding door, that is slidable along a running rail, and with which a room opening can be closed. The invention relates further to a carriage and to a running rail for this guiding device.

For separating or creating rooms or for closing openings of rooms or windows, often sliding elements are used, such as sliding doors made from glass or wood, which typically are guided with two carriages along a running rail. E.g., from [1], US7891052B2, a device is known with a carriage that can be guided along a running rail and that serves for holding a glass panel or a sliding door made of glass, respectively. The carriage is connectable to the glass panel by means of fittings, so that the upper edge of the glass panel can be received within the cross-section of the running rail. This allows partial closing of the space between the glass panel and the running rail, so that, when the sliding door is closed an improved reduction of the noise is achieved that passes through the opening closed by the sliding door into the separated room.

However, noise reduction and further media insulation that can be achieved with this sliding door, is not compatible with the insulation that can be achieved with pivotally held doors that however exhibit different disadvantages.

The present invention is therefore based on the object of creating an improved guiding device for a sliding element, particularly a sliding door. In particular, a guiding device for a sliding element shall be created, with which an opening can be closed tightly, particularly soundproof. Further, a

carriage and a running rail for such a guiding device shall be defined.

The guiding device, which serves for guiding a sliding element, such as a sliding door provided with a door leaf, with which a room opening of a building part can be closed at least approximately tightly, comprises a running rail having a longitudinal axis and at least one carriage that is guided along the running rail and that comprises a carriage body that is connected to a coupling device that is coupled or can be coupled with the sliding element.

Preferably, the sliding element, which comprises a door leaf made of wood, glass, plastic or metal, is held by of two carriages. For coupling the carriages to the sliding element, appropriate fittings are provided on the door leaf.

According to the invention, the running rail comprises a first and a second track that run in parallel and that are inclined towards one another. The carriage body holds first and second running elements that are inclined towards one another and that are supported by the corresponding first or second track, whereby at least one of said first and second tracks comprises a first track section running in parallel to the longitudinal axis and a second track section, along which the carriage can be driven into a terminal position, running inclined to the longitudinal axis.

In this way, with a simple construction of the carriage, it can be ensured that the carriage can be guided along the longitudinal axis of the running rail and then can be driven in at least one end region of the running rail inclined to the longitudinal axis, i.e. particularly against the room opening. Thereby, the running elements are in every position along the running rail in optimal contact with the tracks. With a

corresponding inclination of the running rail it can be reached that the first running elements carry a substantial part of the load of the sliding element, while the second running elements serve for laterally guiding the sliding element and receive only a small part of the load. In principle, the inclination of the running rail can be selected freely. Preferably the first and second tracks, which are facing the ceiling, are inclined by +45° and -45°, respectively, against the vertical line or the plane of the sliding door, whereby a correction angle, that lies in the range from -25° to +45°, can be added, in order to increase or reduce the horizontal or vertical deflection of the sliding door accordingly.

The first and second running elements, which preferably are provided in pairs, are preferably track rollers, wheels, gliding elements or magnet elements. Combinations of different running technologies can advantageously be applied. E.g., for the first running elements a low noise magnetic running technology or sliding technology is used, while for the second running elements rollers or wheels are applied. The running surfaces of the running elements seated on the tracks of the running rail, which are inclined towards one another, enclose preferably the same inclination angle as the tracks of the running rail and preferably are arranged in a distance of 0,5cm-3cm near one another, which allows a compact construction of the carriage.

In a first preferred embodiment the carriage is therefore not guided along a straight line, but in a plane that is defined by the first track of the running rail. The way the carriage passes within this plane is defined by the second track, which, in the manner of a link mechanism, comprises at least the two track sections that are inclined towards one another.

The plane, on which the carriage is driven, is therefore defined by the inclination of the running rail and the first track, respectively, which comprises only one track section. The deviations of the path, the carriage passes within this plane, are determined, by the slope of the second track or the slope of the track sections, respectively.

Hence, with the inventive guiding device a sliding door can be moved not only in linear direction, but as desired laterally and vertically. The amount by which the sliding door is laterally moved when sliding along the second track section and the amount by which sliding door is vertically moved when sliding along the second track section or the second track sections can be adjusted by selecting the inclination of the running rail and the track sections. This calibration can either be defined at factory side or installation side. In order to allow the carriage to pass a defined pathway without obstruction, the connection between the carriage body and the sliding door comprises at least one pivot. The carriage shall be able to incline or turn, while the alignment of the sliding door shall remain unchanged.

In order to ensure that two carriages can execute identical movements, e.g. on a common first track in a common plane, identical second tracks, if appropriate identical rail segments are provided for both carriages, which are synchronously travelled by the carriages. A sliding door suspended on both carriages is therefore moved in parallel to the room opening when the carriages are deflected. In a preferred embodiment, corresponding guiding elements are provided at the lower side of the sliding door, which support the described closing procedure.

Hence, the sliding door can optionally be moved along a straight line and then laterally towards a room opening and be

lowered, in order to tightly close the room opening. The second track forms a link mechanism with a horizontal first track section and with a second track section inclined downwards, which is driven through buying the related carriage when the sliding element is closed.

In a further embodiment, both tracks are provided with second track sections that are inclined relative to the longitudinal axis of the running rail. Hence, in this case, the carriage no longer drives within a plane, but along the two second track sections in the terminal position. In this way a further degree of freedom results for the selection of the track, along which the sliding element is driven into the terminal position. E.g., the carriage can be driven to a side, while avoiding a vertical movement. However, also in this case it is possible, that the sliding element is lifted or lowered while driving into the terminal position.

Thereby it can be arranged that the sliding door completely traverses the distance to a wall only or the distance to the floor only and thus abuts in the terminal position the wall and/or the floor. Hence, the guiding device can be adjusted on factory side or installation side in such a way that the sliding door abuts in the terminal position the wall or the frame bordering the room opening at a desired position and/or the floor.

In further preferred embodiments, additional second track sections can be provided on the one or the other end of the running rail or the rail segments. The second track sections can also be curved.

The inclination the first and second track of each rail segment and the inclinations the second track sections versus the first track sections are selected in such a way, that the

sliding element traverses within a closing path, that corresponds to the length of the second track section, a distance between the front side the sliding door and the edge of the room opening and a distance between the lower side of the sliding door and the floor.

The inventive guiding device therefore allows tightly closing a room opening on all sides. In order to reach an optimal sealing also in view of further media and to avoid collisions of the sliding door, the sliding door is preferably provided with a sealing gasket on the front side facing the room opening or on the frame or edge of the room opening. This sealing gasket runs along the edge of the sliding door or the door leaf, respectively, and, if a sealing towards the floor is required, overlaps the lower side of the door leaf. The sealing gasket runs preferably in one piece in a closed loop along the periphery of the door leaf. Alternatively, sealing elements can be assembled. The sealing gasket preferably consists of an elastic element, which comprises a compressible hollow body, preferably a bellow. However, any other sealing, such as a sealing gasket with an elastic sealing lip can be used.

It is further possible, to apply a sealing on at least one side of the door leaf only, e.g. on the lower side and/or upper side. Alternatively, it is possible to apply said sealing or sealing elements not on the door leaf, but on the building side.

Further, the carriages can be motorised, so that the sliding door can automatically be operated and can be driven with higher force into the terminal position, thus increasing the contact pressure exerted onto the sealing gasket.

The running rail can be manufactured in one piece or can be separated in rail segments, which are subsequently mounted behind one another or side-by-side. Thereby the lengths of the rail segments is selected in such a way that, when moving the carriages along the rail segments, a room opening can be opened or closed completely with the sliding door held by the carriages. E.g., a running rail can be split into two rail segments and can be installed at installation site by means of a mounting profile that preferably is assembled from several identical parts. Hence, the individual parts of the guiding device can be packed up at factory site with reduced space requirement and can be assembled and set up at installation site. If the second tracks of the running rail are arranged behind one another, then the carriages run only within the related second track and cannot get into the range of neighbouring second tracks. However, a running rail can be provided with second tracks that overlap one another. A plurality of second tracks is preferably arranged side-by-side. As well, rail segments can be arranged side-by-side. To allow each carriage to drive through the overlapping second track with the second rollers, the second rollers are mounted in a corresponding distance. Preferably, the second shafts are provided with a corresponding length, allowing holding the second track rollers at least in a first or a second position above the assigned second track.

The running rail, which preferably consists of several rail segments, can be mounted above the sliding element or below the sliding element, whereby the tracks are directed towards the ceiling in each case. In the first case, the sliding element is suspended preferably on two carriages. In the second case the sliding element is supported by a running rail.

In spite of using a running rail with two tracks, the invention allows to construct the carriages in compact form with at least one first shaft for holding the at least one first running element and with at least one second shaft for holding the at least one second running element.

The carriages preferably comprise two carriage channels or wheel channels, respectively, inclined towards one another, in which the running elements or the track rollers, respectively, are held in such a way that they face the related tracks of the running rail and are seated on them, planar or linear.

The carriage channels preferably consist of two U-profiles connected with one another, with their sides facing one another connected with one another and preferably forming a part of a carriage body. However, the running elements can also be held by the carriage body only, which is designed accordingly.

For the purpose of connecting the carriage with the sliding element, a coupling device is provided that is connected with the carriage body, e.g. with one of the channel walls or the carriage block. If the sliding element is suspended on the running rail, then the coupling device extends into the range below the carriage. If the sliding element is supported by the running rail, then the coupling device is held above of the carriage.

If the carriage body comprises a carriage block, then the carriage block can advantageously be provided with body bores, which serve for receiving the first and second shafts. The shafts, which preferably comprise each a flange head and a piston, can be inserted into the body bores until the flange head abuts a collar adjoining the related body bore. The

piston of each shaft extending out of the carriage body can be provided with a running element or with a track roller.

The carriage body and the sliding element, preferably the carriage body and the coupling device, are connected with one another by at least one pivot in order to allow the carriage to drive along the running rail without obstruction. Hence, the carriage can turn in the plane defined by the first track or along the two track sections without obstruction.

Further, the coupling device preferably comprises a coupling element, which holds the sliding element vertically aligned below or above and preferably between the pairs of first and second track rollers. In this manner the load of the sliding element is distributed equally onto both pairs of track rollers, thus avoiding the transmission of disturbing mechanical moments onto the running rail.

The pivot can advantageously be created by introducing a bore into the carriage body a preferably aligned in parallel to the second shafts. Into the bore a bearing bush is inserted, which comprises a flange ring that is held by a collar, which is adjoining the bore. In a preferred embodiment the bearing bush traverses the second wheel channel and is held on its end in a bore in the second wing element. A pivot pin that is provided with a flange head and that is connected to the coupling element can be inserted into the bearing bush and is rotatably seated there in. The carriage body can therefore freely turn relative to the coupling element. This embodiment of the pivot requires little space and can easily be made. However, alternative embodiments of the coupling device and the pivot can also be applied.

On the side opposite to the running rail, the sliding element is preferably provided with a guide element, with which the

sliding door, also during the closing procedure, is always held in parallel to the room opening, so that the sliding door can be guided on each frame section with the same pressing force against the room opening, thus evenly compressing the sealing gasket provided on the sliding door or the wall. For this purpose on the related side of the sliding door or hidden in the floor a guide rail is provided, which comprises inclined guide sections that corresponds to the track sections of the running rail. A guide element, preferably a guide wheel of an adjustable carriage, engages in the guide rail, and ensures that the sliding door is moved according to the slope of the guide rail. If required, further options for the adjustment of the guide elements, e.g. with a vertical displacement of the guide elements, can be provided.

In a further preferred embodiment, the first carriage or a corresponding terminal stop is provided with a damping device, which ensures that the sliding door, with the support of gravity, can run automatically and smoothly into the terminal position. Due to the inclination of the second track sections in an automatic closing action can be achieved without the need for expensive drawing devices. The damping device preferably comprises a hydraulic damper. Further, an elastic element can advantageously be provided that absorbs kinetic and potential energy, which is set free by the sliding door during the drive into the terminal position. The damping device can also be mounted within the running rail. With the inventive solution and, if present, support of the energy stored in the damping device, the force for operating the sliding door, manually or with a motor, can be kept low.

Below, the invention is described in detail with reference to the drawings. Thereby show:

Fig. 1 an inventive guiding device 1, with which a sliding door 10 provided with sealing elements 12 can be displaced in such a way, that a room opening 9 can be opened and tightly closed;

Fig. 2 the guiding device 1 of figure 1 with the sliding door 10 in the terminal position, in which the room opening 9 is tightly closed;

Fig. 3 the sliding door 10 of figure 1 with the front side 3 facing the room opening 9;

Fig. 4 the sliding door 10 of figure 3 that is pivotally connected via a coupling device 2 with the body 33 of an inventive carriage 3, which comprises two roller pairs 31, 32 aligned perpendicular to one another;

Fig. 5a-c the carriage 3 of figure 4 with a running rail 4 or a segment 4A of a running rail 4 with a first track 41 for supporting the first roller pair 31 and a second track 42 for supporting the second roller pair 32 that is aligned perpendicular to the first track 41 and that comprises two track sections 421, 422 inclined towards one another;

Fig. 6 an inventive guiding device 1 with two carriages 3A, 3B according to figure 5a, that are seated on rail segments 4A; 4B, of the running rail 4, which rail segments 4A; 4B are arranged behind one another as shown in figure 5a;

Fig. 7 a running rail 4 with second tracks 42A, 42B or rail segments 4A; 4B as shown in figure 5a arranged side-by-side and shifted relative to one another;

Fig. 8 an inventive guiding device 1 with a running rail 4 that is held by a mounting profile 7 and on which an inventive carriage 3 is seated;

Fig. 9 the carriage 3 and the coupling device 2 of figure 4 separated from one another;

Fig. 9a parts of the coupling device 2 shown in figure 9;

Fig. 10a-c the body 33 of the carriage 3 of figure 4 in different illustrations with elements 251, 252 of the coupling device 2 and shafts 311, 321 of the roller pairs 31, 32 inserted therein;

Fig. 11 the lower side the sliding door 10 of figure 1 with a guide rail 6, in which a first stationary guide carriage 5A is permanently engaged, and a guide fork 65, into which a second stationary guide carriage 5B can engage as soon as the sliding door 10 richest the end position;

Fig. 11a the guide rail 6 of figure 11 with the stationary first guide carriage 5A engaging therein;

Fig. 11b the guide fork 65 of figure 11 before the arrival at the second guide carriage 5B;

Fig. 11c a guide carriage 5 in sectional view;

Fig. 11d a segment 120 of the sealing element 12 of the sliding door 10 shown in figure 1;

Fig. 12 a damping device 8 connected to an inventive carriage 3;

Fig. 12a in explosion view, the damping device 8 of figure 12;

Fig. 13a-c an inventive running rail 4 in different inclinations supporting carriages 3 with different carriage bodies 33, 330;

Fig. 14a-b in a further preferred embodiment an inventive running rail 4 and an inventive carriage 3, which are serving for supporting a sliding element 10 held above the running rail 4;

Fig. 15 the carriage 3 of figure 14a with a coupling device 2 with which the carriage 3 is connected with a fitting 21 that holds the door leaf 11;

Fig. 16 a sliding door 10 held by a guiding device 1 and serving for closing a wall opening 9, that is either supported below by a running rail 4 arranged in a floor channel 920 or that is suspended above on a running rail 4 arranged in a ceiling channel 910;

Fig. 17 the guiding device 1 of figure 16 with the running rail 4 held by a mounting profile 7 within the floor channel 920 of figure 16;

Fig. 18 a-b a view into the floor channel 920 of figure 17 from the front side and the rear side;

Fig. 19 a-b the running rail 4 of figure 17 with two rail segments 4A, 4B, on which carriages 3A, 3B are guided that are connected via coupling devices with a fitting strip 21 that holds a door leaf 11;

Fig. 20 the running rail 4 of figure 17 with the two tracks 41, 42, which comprise each a first track section 411, 421 running in parallel to the longitudinal axis x and each a second track

section 412, 422 running inclined to the longitudinal axis x;

Fig. 21 the running rail 4 of figure 17 with the two rail segments 4A, 4B, on which the carriages 3A, 3B are guided and a closing carriage 900 that is guided on the mounting profile 7 of figure 17 and that serves for closing the floor channel 920; and

Fig. 22 a-b the guide rail 6 of figure 11 held in a mounting profile 60 arranged within the ceiling channel 910 of figure 16, with guide carriages 5A, 5B guided in the guide rail 6 that are connected to a fitting bar 51 mounted on the door leaf 11.

Figure 1 shows an inventive guiding device 1 in a first embodiment with a sliding door 10, that is partially opened and that is guided by carriages 3 along a running rail 4, which is mounted by means of a mounting profile 7 on a building wall 91. With the sliding door 10 a room opening 9 can be opened or tightly closed. For this purpose, the sliding door 10 can be moved forward until the room opening 9 is completely covered, as shown in figure 2. During the closing process in a terminal section along a distance Sxc, the sliding door 10 is not only guided in parallel in front of the room opening 9 (see arrow A), but also over a distance Sy towards the room opening 9 (see arrow B) and over a distance Sz towards the floor 92. Hence, the sliding door 10 covers an edge 111 of the room opening 9 with minimal margin. Consequently already with this positioning of the sliding door 10 a good ceiling of the room opening 9 is achieved.

In order to further improve the sealing, the front side 111 of the sliding door 10 that is facing the room opening 9 is peripherally, preferably adjacent to the edge of the door leaf 11 provided with a sealing gasket 12, which preferably forms a closed rectangular loop. Hence, in the closing position the

upper first part 121 of the sealing gasket 12 is guided towards the frame 911 of the room opening 9. On the lower side the sliding door 10, a lower second part 122 of the sealing gasket 12 overlaps the door leaf 11 and touches the floor 92 after the sliding door 10 has been closed. Alternatively, elements of the sealing gasket can be mounted on the frame 911 of the room opening 9 and on the floor 92.

Figure 3 shows the front side 111 of the sliding door 10 with the sealing gasket 12 mounted thereon by means of mounting elements 123 (see figure 11). The sealing gasket 12 can also be embedded in a receiving groove provided in the sliding door or in a receiving groove provided in the frame or edge that is adjoining the room opening 9.

The sealing gasket 12 is preferably an extruded plastic profile that forms for example a hose arranged in a closed loop with at least one sealing chamber. A section 120 of the sealing gasket 12 is shown in a preferred embodiment in figure 11d. In this embodiment, the sealing gasket 12 comprises a first a sealing member 1210 facing the building wall 91 and a second sealing member 1220 facing the floor 92. The sealing champers are easily compressible, so that the sealing gasket 12 lies planar on the frame 911 of the room opening 9 or at the floor 92 after the sliding door 10 has been closed.

In the embodiment shown in figure 18a the sealing gasket 12 is arranged completely on the front side of the sliding door 10 and is directed completely against the frame of the room opening 9. Touching the floor with the sealing gasket 12 is avoided. In this embodiment, the sliding door 10 can be operated with further reduced force.

In the closing position of the sliding door 10 the room opening 9 is tightly closed, thus providing optimal insulation with regard to any media. The closed room is optimally protected against external influences, such as sound, odour wind and draft.

In the embodiment of figure 1 the sliding door 10 is suspended on a running rail 4. Figure 17 shows that the sliding door 10 can also advantageously be seated on a running rail 4. Hence, the running elements and guide elements installed at the lower side and the upper side of the sliding door 10 are exchangeable, according to the principal of kinematic reversal.

Figure 4 shows the sliding door 10 of figure 3 that is pivotally connected via a coupling device 2 with the body 33 of an inventive carriage 3, which comprises two roller pairs 31, 32 that are inclined perpendicularly to one another and are directed towards to one another at the lower side. The coupling device 2 comprises a connecting part, i.e. a connecting shaft 23 that is provided with a threading, if appropriate, and that is held in a mounting block 22. The mounting block 22 is anchored in a fitting 21 that is formed as a U-profile and is provided with holding ribs and is held by means of screws in a recess 13 provided at the upper edge of the wooden door leaf 11. This fitting technique is shown as an example only. For glass panels the solution disclosed in [2], US6052867A1, can advantageously be applied. In the shown embodiment the connecting part 23 is held by a coupling element 24, which itself is connected by a pivot 25 with the body 33 of the carriage 3.

Figures 5a, 5b and 5c show the inventive carriage 3 of figure 4 with a running rail 4 or a segment of a running rail 4 that is mounted above the sliding door 10. The running rail 4 is inclined upwards and comprises a first track 41 for supporting the first roller pair 31 and second track 42 inclined perpendicular thereto for supporting the second roller pair 32 auf. The second track 42 comprises two track sections 421, 422 that are adjacent and inclined towards one another. Figure 20 shows, that in preferred embodiments, not only one, but both tracks 41 and 42 comprise two track sections 411, 412 and 421, 422 each that are inclined towards one another. This allows a movement of the carriage 3 inclined to the longitudinal axis x

the running rail 4 without a vertical movement of the carriage 3.

In the shown embodiment, both first and second tracks 41 and 42, which are facing the sealing, enclose an angle of 90° and are inclined relative to the vertical line by an angle of at least approximately +45° or -45° respectively. As shown in figure 5a, the roller pairs 31, 32 exhibit a corresponding inclination. It is further shown that the carriage 3 can further be inclined by a correction angle kw preferably in the range of +25° to -22,5°. Further, it is possible to increase the correction angle kw up to 45°, so that the first guide elements carry the load and the second guide elements serve for lateral guidance. With a corresponding inclination of the carriage 3 and the running rail 4 the grade of the lateral and vertical deflection of the sliding door 4 can be set, which further depends on the slope of the second track 42, particularly the inclination of the second track section 422 (see the description relating to figures 13a, 13b and 13c) or the second track sections 412, 422 (see the description relating to figure 20).

Figure 5b shows the running rail 4 with the first track 41 that is shown with hatched drawing and on which the first roller pair 31 is seated. The first track 41 lies in a plane that the carriage 3 is consequently following. Figure 5b further shows the second track 42 with the two track sections 421, 422. The second track section 422 can be created in a simple manner by cutting of a part of the running rail 4 perpendicularly to the first track 41.

For the installation of the running rail 4 a mounting strip 43 is provided with mounting bores 431 serving for receiving mounting screws. With the mounting screws the mounting strip 43 is connected with a profile element 71 of a mounting profile 7, as shown in figure 8. The mounting profile 7 preferably consists of a plurality of identical profile segments 7A, 7B, ... and can therefore also be assembled at

installation site. For the installation of the mounting profile 7 at a building wall 91, mounting openings 72 are provided through which screws are introduced. The running rail 4 can also be mounted by means of other connection techniques, e.g. by using an adhesive or by casting.

After the installation of the running rail 4, the first track 41 and the first track section 421 of the second track 42 are aligned at least approximately horizontal. Hence, when moving along the first track section 421 the carriage 3 follows a horizontal line or the longitudinal axis of the running rail 4. At the transition from the first to the second track section 421; 422 the carriage 3 turns with its front side that is provided with a damping element 80, with an inclination downwards. This turn is executed unobstructed, since the carriage body 33 is connected to the coupling device 2 or to the angular coupling element 24 via a pivot 25. Hence, the carriage 3 can turn unobstructed and can follow another axis within the plane that is defined by the first track 41. Since the second track section 422 corresponds to a part of the upwards inclined running rail 4, which part is tapered wedge shaped in downward direction, the carriage 3 moves laterally inclined downwards and therefore towards the room opening 9 and the floor 92.

Figure 5c shows the carriage 3 and the running rail 4 of figure 5b with a view on to the second track 42 on which the track sections 421, 422 are shown with different hatchings.

Figure 6 shows two carriages 3A, 3B and two rail segments 4A, 4B arranged behind one another of the running rail 4 according to figure 5b. On the first carriage 3A the coupling device 2 with the coupling element 24 is shown. On the second carriage 3B the coupling element 24 has been disassembled. The carriages 3A, 3B and the rail segments 4A, 4B are designed identical and can be delivered and installed separately. The distance between the carriages 3A, 3B corresponds preferably to the length of the rail segments 4A, 4B that are combined

with one another. The distance between the carriages 3A, 3B is selected in such a way that the carriages 3A, 3B are always located within the related rail segments 4A, 4B at corresponding positions and thus are moved synchronously. The terminal stops of the sliding door 10 are arranged in such a way that the carriages 3A, 3B can travel on the thereto assigned rail segments 4A, 4B only.

In order to vary the length of the running path of the sliding door 10 as desired, the running rail 4 shown in figure 7 is provided with a second track 42A, 42B arranged side-by-side for each of the carriages 3A, 3B. Hence, the second running elements 32A, 32B of the carriages 3A, 3B are offset relative to one another and are seated on the related track 42A or 42B, respectively. Figure 13b shows a correspondingly designed carriage 3 with a second roller pair 32 that can optionally be moved along the elongated shafts 321' onto the outer or inner track 42A, 42B. A correspondingly designed running rail 4 can be made in one piece or can consist of a plurality of assembled elements. Particularly with this embodiment the running rail 4, the second tracks 42A, 42B can comprise a plurality of inclined second track sections 422A, 422B. Particularly at the ends of the rails inclined second track sections 422A, 422B can be provided. Thereby it is possible to close one of two room openings 9 with the sliding door 10.

Figure 8 shows the running rail 4 connected to the mounting profile 7 in a preferred embodiment. In this embodiment, the profile elements 4 and 7 can be provided to the simple design. However, the mounting profile 7 and the running rail 4 can also be integrated into one another, so that the mounting profile 7 encloses the running rail 4 in one piece. For this purpose, e.g. the mounting flange 71, which already comprises two inclined surfaces facing upwards, is extended as far as required, e.g. up to the intersecting line of the two tracks 41, 42 of the running rail 4.

Figure 9 shows the carriage 3 with the disconnected coupling device 2. It is shown that a pivot pin 252, possibly a hollow shaft, extends from the body 33 of the carriage 3 that is pivotally held in a bearing bush 251 (see figure 10c). The pivot pin 252 corresponds to the mounting bore 241 provided in the coupling element 24. Hence, the coupling element 24, which is firmly connected to the pivot pin 252, is held rotatable relative to the carriage 3.

Figures 9 and 9a show that in the coupling element 24 a slide 26 is slidably seated. By turning a screw-nut 27, which is connected with a threaded bolt 261 of the slide 26, the slide 26 can be moved forward and backward. The threaded bolt 261 is guided through an opening provided in the coupling element 24. Further, slide 26 comprises a threaded bore 262, in which the connecting element 23 that is anchored in the mounting block 22 is pivotally held (see also figure 4). Hence, by shifting the slide 26 and turning the connection element 23 the sliding element 10 can be moved forward and backward as well as upward and downward.

Figures 10a, 10b and 10c show a preferred embodiment of the body 33 of the carriage 3 of figure 4 in different illustrations (from the backside) with therein introduced elements 251, 252 of the coupling device 2 and shafts 311, 321 provided for holding the roller pairs 31, 32. The shafts 311, 321 comprise each a flange head 3111; 3211 and a piston 3112; 3212. The symmetrical carriage body 33 comprises a carriage block 333 with body bores 3331, 3332 for receiving the first and second shafts 311, 321, which are inserted into the body bores 3331, 3332, until their flange head 3111; 3211 is held by a collar 33310; 33320 that is adjoining the related body bore 3331; 3332 (see figure 10c).

In the same manner a bushing bore 3333 is provided that runs in parallel to the second shafts 321 and that is limited at the lower side by a collar 33330. Hence, the bearing bush 251 that is provided with a flange ring 2511 can traverse the

bushing bore 3333 until the flange ring 2511 is seated on the collar 33330 of the bushing bore 3333, as shown in sectional view in figure 10a.

As shown in figure 10b, the shafts 311, 321 of the roller pairs 31, 32 and the bearing bush 251 can therefore be inserted through the carriage block 333 into the mounting positions and can therefore be mounted in a simple manner. While manufacturing of the carriages 3 is significantly simplified in this way and carriages 3 with a compact design result, the weakening of the carriage block 333 caused by the provided bores is insignificant. Figure 10b shows that in addition, even an axial bore 3334 can be provided serving for receiving a damping element 8, 80.

As already shown in figure 13b the carriage body 33 can consist of the mounting block 330 alone. However, in the preferred embodiments of figures 10a, 10b and 10c the carriage block 333 is provided on each side with a first or second wing element 331; 332. The first region of the first wing element 331 is aligned in parallel to the first body bores 3331 or to the first shafts 311. Then the wing element 331 is aligned perpendicularly thereto so that a first wheel channel 310 is formed. The first shafts 31 traverse the first wheel channel 310 upright and are seated with their ends in wing bores 3311 provided in the first wing element 331. The first region of the second wing element 332 is aligned in parallel to the second body bores 3332 or two the second shafts 321. Then the second wing element 332 is aligned perpendicularly thereto, so that a second wheel channel 320 is formed. The second shafts 32 traverse the second wheel channel 320 upright and are seated with their ends in wing bores 3322 provided in the second wing element 332. The second wing element 332 comprises a further wing bore 3323 serving for additional support of the

bearing bush 251. The two wing elements 331 and 332 form a right angled angular element and serve for secure holding of shafts and joint elements. At the same time the roller pairs 31, 32 are protected in the related wheel channel 310, 320.

Figure 10c further shows the pivot pin 252 that is provided with a flange head 2521 and that is pivotally seated in the bearing bush 251.

By means of the running rail 4 and the carriages 3 guided therewith, the sliding door 10 is guided at the upper side in the embodiments described above. To ensure, that the sealing gasket 12 provided at the front side 111 of the door leaf 11 is not only pressed on the upper side but over the whole area equally towards the edge the room opening 9 when the sliding door 10 is closed, preferably also on the lower side are guide elements provided, namely a guide rail 6 and preferably a guide fork 65, into which guide wheels 55 of guide carriages 5A, 5B that are stationary mounted on the floor 92 can engage. The guide rail 6 is embedded into a receiving groove 16 provided at the lower side of the sliding door 10. The guide fork 65 is also arranged within the receiving groove 16, on one end in closing direction.

The guide rail 6, shown from the backside in figure 11a, comprises a first guide segment 61 running in parallel to the door leaf 11 and a second guide segment 62 that is running inclined thereto and that comprises a length corresponding to the length of the second track section 422 of the second track 42 and therefore to the closing distance Sxc. Hence, the first guide carriage 5A, that engages with the guide wheel 55 in the guide rail 6, reaches the second guide segment 62 in that moment in which the second carriage 3B guided on the running rail 4 reaches the second track section 422. Subsequently the upper side and the lower side of the sliding door 10 are

guided synchronously towards the room opening 9. At the same time the second guide carriage 5B engages in the guide fork 65 that is shown in figure 11b and that comprises a guide channel 652 and guide strips 651, 653 adjoining thereto. The guide strips 651, 653 comprise different thicknesses. Hence, when the guide wheel 55 of the second guide carriage 5B is guided over a ramp of the thicker guide strip 651, then the front side of the sliding door 10 is guided by the second guide carriage 5B and the first carriage 3A, that is supported by the running rail 4, towards the room opening 9 or the building wall 91 respectively.

Based on the principle of kinematic reversal, the device members described above can be exchanged or replaced. E.g., the guide rail 6 and the guide fork 65 can also be mounted stationary on the floor 92 or embedded therein, while guide elements, such as the guide carriages 5A, 5B, are mounted on the lower side of the sliding door 10. Alike, the sealing gasket can be mounted on the wall and not on the door leaf. E.g., a part 121 of the sealing gasket 12 can be mounted on the frame 911 of the door opening 9 and the remaining part 122 of the sealing gasket 12 at the lower side of the sliding door 10.

Figure 11c shows one of the adjustable guide carriages 5 in sectional view. The guide carriage 5 comprises a housing 51 with a tool channel 511. Further, a threaded insert 52 is inserted into the housing 51. Into the threaded insert 52, a threaded part 531 with an eccentrically held bearing axle 53 is inserted that holds on the other side the guide wheel 55. Hence, by turning the threaded part 531, the bearing axle 53 is moving along a circle. The threaded part 531 holds a geared ring 532 that is facing the tool channel 511. Hence, the

geared ring 532 can be grasped and turned by a tool, which is introduced into the tool channel 511.

Figure 11d shows the sealing element 12 that has been described above, with the two sealing chambers 1210, 1220.

Figure 12 shows a damping device 8 that is connected to an inventive carriage 3. With the damping device 8 the run of the sliding door 10 can be damped in the closing region and its potential and/or kinetic energy can be stored in an elastic element. The damping device 8 is held in a recess of the carriage body 33 and directed towards a terminal stop.

Figure 12a shows the individual parts of the damping device 8, mainly a hydraulic damper 81 with a central plunger 811 held in a damping cylinder 812, an elastic element 82, a hollow cylindrical plunger 85 and a damping element 80 made from plastic or rubber that is seated on the central plunger 811 and the hollow cylindrical plunger 85. As soon as the damping element 80 hits the terminal stop, the central plunger 811 and the hollow cylindrical plunger 85 are actuated, causing a reaction of the damping cylinder 812 and tensioning the elastic element 82. The energy stored in the elastic element 82 will be set free again when opening the sliding door 10. Hence, for traversing the closing distance Sxc during the opening process practically no additional force is required.

Figures 13a, 13b and 13c show an inventive running rail 4 with different inclinations, supporting carriages 3 that comprise carriage bodies 33, 330 with different designs. The carriage body 330 of the carriage 3 of figure 13b does not comprise wing elements and consists of the carriage block 333 only. Further, this carriage 3 comprises elongated second shafts 321', along which the second roller pair 32 can be moved

inwards or outwards into a position, in which a second track 42, that is assigned to this carriage 3, can be contacted.

As described above, the degree of the lateral and vertical deflection of the carriage 3 can be adjusted with the inclination of the running rail 4. With the inclination shown in figure 13a, higher vertical and lower lateral deflections of the carriage 3 result. With the inclination shown in figure 13c, higher lateral and lower vertical deflections of the carriage 3 result. With the inclination shown in figure 13b the lateral and vertical deflections of the carriage 3 are approximately equal.

Figures 14a and 14b show in a preferred embodiment a running rail 4 mounted on the floor with two tracks 41, 42 that are facing the ceiling, that are inclined towards one another by 90° and that comprise each two track sections 411, 412; 421, 422 that are inclined towards one another. The carriage 3 can be moved forward along the first track sections 411, 412 in parallel to the longitudinal axis x of the running rail 4 up to the second track sections 412, 422 and then along the second track sections 412, 422 inclined to the longitudinal axis x towards the room opening 9. With this embodiment it is possible, to drive the carriage 3 along the second track sections 412, 422 with any positive or negative inclination towards the room opening.

Figure 14a shows the carriage 3 positioned at the beginning of the first track sections 411, 421. Figure 14b shows the carriage 3 at the end of the second track sections 412, 422 close to the room opening 9.

Figure 15 shows the carriage 3 of figure 14a that can be connected via a coupling device 2 to a strip-like fitting 21. In this preferred embodiment, the carriage 3 comprises two U-

profiles that are connected with one another and that enclose each a wheel channel 310, 320. In the first wheel channel 310 the two first track rollers and in the second wheel channel 320 the two second track rollers are held. The carriage body 33 comprises a pivot pin 242, which can be held in a mounting opening 241 of a coupling element 24. Again, the coupling element 24 and the carriage 3 are pivotally connected with one another. On the other side of the coupling element 24 a bore is provided for receiving a jacket-like connection element 23. The connecting element 23 held, optionally pivotally, on one side in the coupling element 24 and on the other side in a bore 210 provided in the strip-like fitting 21 is therefore holding and supporting the door leaf 11. Hence, again, the carriage 3 is pivotally held relative to the sliding door 10 and can perform the required movements along the running rail 4.

Figure 16 shows a sliding door 10 that is held by an inventive guiding device 1 and that serves for closing a wall opening 9. The sliding door 10 is either supported below with a running rail 4 embedded in a floor channel 920 or suspended above on a running rail 4 embedded in a ceiling channel 910. Figure 16 illustrates that the elements of the guiding device 1, the running rail 4 and the guide rail 6 can be exchanged and can be mounted advantageously in a floor channel 920 and in a ceiling channel 910. Further separation elements 90A, 90B, preferably glass panels, are shown that extend into the floor channel 920 below and above into the ceiling channel 910 and which delimit the room opening 9 laterally. It can be seen that the whole closing system with the sliding door 10 can elegantly be designed. The inventive running rail 4 allows the sliding door 10 to be driven precisely between the separation elements 90A, 90B, so that the sliding door 10, together with the separation elements 90A, 90B, forms a planar separation

wall. With this embodiment of the guiding device 1, with device parts held in the floor channel 920 and in the ceiling channel 910 and with the door leaf 11 extending into the floor channel 920 and into the ceiling channel 910, further advantages result. The room opening 9 is optimally closed and sealed. A sealing towards the floor and towards the ceiling is no longer required, since the sealing in front of the sliding door 10 towards the edges 91, 93 of the room opening 9 is fully sufficient. Hence, only one sealing plane remains with the advantage that for the operation of the sliding door 10 only minimal handling forces are required.

Figure 17 shows the guiding device 1 of figure 16 with the running rail 4 held in a mounting profile 7 within the floor channel 920 of figure 16. Further shown is the separation element 90A that is also held in the mounting profile 7 by means of sealing elements 94. The floor channel 920 is covered with cover elements 921, 922, which leave open only the travel path of the sliding door 10. Figure 21 shows that this travel path can be closed by means of a closing carriage 900, when the sliding door 10 is moved aside. Figure 17 further shows a limiting strip 93 held between the separation elements 90A, 90B.

Figures 18a and 18b show the floor channel 920 of figure 17 from the front side and the backside.

Figure 18a shows the first rail segment 4A of the running rail 4 that is held within mounting profile 7 and holds the first carriage 3B. It is further shown that the mounting profile 7 comprises rail elements 75, 76, on which the closing carriage 900 is seated.

Figure 18b shows the second rail segment 4B of the running rail 4 that is held within the mounting profile 7 and that

holds the second carriage 3B. Further shown is the closing carriage 900 that rolls with wheels 901, 902 on the rail elements 75, 76. The closing carriage 900 comprises a cover plate 905, with which the opening in the floor can be closed after the sliding door 10 has been moved aside.

Figures 19a and 19b show the running rail 4 of figure 17 with two rail segments 4A, 4B, on which carriages 3A, 3B are guided. The carriages 3A, 3B are connected via coupling devices 2 with a fitting bar 21 that holds a door leaf 11. A strip-like sealing element 12 with a sealing lip is provided at the lower side of the door leaf 11, which sealing element 12 is forwarded during the closing procedure towards the limiting strip 93 shown in figure 17.

Figure 20 shows the running rail 4 of figure 17 or the rail segment 4, respectively, with two tracks 41, 42, that comprise each a first track section 411, 421 that are aligned in parallel to the longitudinal axis x and each a second track section 412, 422 that are inclined to the longitudinal axis x.

Further, figure 20 shows a carriage 3 that comprises only one first running element or running roller 31 and only one second running element or a running roller 32,. In all described embodiments of the inventive guy device 1, inventive carriages 3, 3A, 3B can also be provided with only one first and only one second running element 31, 32.

Figure 21 shows the running rail 4 of figure 17 with the two rail segments 4A, 4B, on which the carriages 3A, 3B are guided. Further shown is the closing carriage 900 of figures 18a and 18b, which is guided on the mounting profile 7. This closing carriage 900, which comprises the cover plate 905, is moved in front of the room opening 9, when the sliding door 10 is moved aside. Hence, the opening remaining in the floor

after removing the sliding door 10 is closed with the cover plate 905 of the closing carriage 900.

If the running rail 4 is mounted on the floor, then the guide rail 6 is mounted on the ceiling preferably in the ceiling channel 910. In embodiment shown in figures 22a and 22b a frame profile 60 is provided, which serves for receiving the guide rail 6 that comprises two guide segments 61, 62 that are inclined towards one another. Rollers of guide carriages 5A, 5B are guided in the guide rail 6. The guide carriages 5A are connected to a fitting bar 510 that is installed at the upper edge of the door leaf 11. In the closing position of the sliding door 10 the first guide carriage 5A is guided by the second guide segment 62 and the second guide carriage 5B is guided by a guide fork 65, which is mounted on the limiting strip 93, towards the room opening 9. Thereby, the sealing gasket 12 that is comprising a sealing lip, that is connected to the fitting bar 51 and that is facing the room opening 9 is guided towards the limiting strip 93. The sealing gasket can also be mounted on the limiting strip 93 and remains invisible if it is arranged within the ceiling channels 910.

Literature

[1] US7891052B2

[2] US6052867A1

List of references:

1	guiding device
10	sliding element, sliding door
11	door leaf, e.g. made from glass or wood
111	front side of the door leaf 11
12	sealing gasket
120	sealing element

13	recess in the door leaf 11
121	upper sealing member
1210	first sealing chamber
122	lower sealing member
1220	second sealing chamber
12230	mounting rib
123	mounting material for the sealing gasket 12
16	receiving groove at the lower side of the door leaf 11
2	coupling device
21	fitting
210	bore for receiving the connecting part
22	mounting block
23	connecting part; shaft or jacket
24	coupling element
240	bore for receiving the connecting part
241	bore for receiving the pivot pin 252
25	pivot
251	bearing bush
2511	flange ring
252	pivot pin
2521	flange head
26	slide
261	threaded bolt
262	threaded bore
27	screw-nut
3; 3A, 3B	carriages
31	first roller(s); carriage wheels
310	first wheel channel
311	first shafts for the first rollers 31
3111	flange head of the first shaft 311
3112	piston of the first shaft 311
32	second roller(s); carriage wheels

320	second wheel channel
321	shafts for the second rollers 32
321'	extended shafts for the second rollers 32
3211	flange head of the second shaft 321
3212	piston of the second shaft 321
33	carriage body
330	carriage body without wing element
331	first wing element
3311	first wing bore for the first shafts 311
332	second wing element
3322	second wing bore for the second shafts 321
3323	third wing bore in the second wing element 332
333	carriage block
3331	first body bore for the first shafts 311
33310	collar for the first shafts 311
3332	second body bore for the second shafts 321
33320	collar for the second shafts 321
3333	bore in the carriage block 333 for the bearing bush
33330	collar for the bearing bush 251
3334	axial bore for receiving the damping device
4	running rail (mounted above or below)
4A, 4B	rail segments of the running rail 4
41	first track
42	second track
421	first track section
422	second track section
43	mounting strip
431	bores in the mounting strip
5,5A, 5B	guide carriages
51	housing
510	fitting; fitting bar
511	tool channel

52	threaded insert
53	bearing axle
531	threaded part of the bearing axle 53
532	geared ring of the bearing axle 53
55	guide wheels
6	guide rail (mounted below or above)
60	frame profile
61	first guide segment
62	second guide segment
65	guide fork
651	first guide strip
652	guide channel
653	second guide strip
7	mounting profile
7A, 7B	profile segments
71	mounting flange
72	bore for receiving a mounting screw
75, 76	rail elements
8	damping device
80	damping element
81	hydraulic damper
811	central plunger
812	damping cylinder
82	elastic element
85	hollow cylindrical plunger
9	room opening, door opening
90	building part
90A, 90B	separation elements, glass walls
900	closing carriage
901, 902	wheels of the closing carriage 900
905	cover plate of the closing carriage 900
91	edge of the room opening 9
910, 920	building channel; ceiling channel or floor channel

911	wall edge covered by the sealing gasket 12
92	floor
921, 922	cover elements
93	limiting strip
94	sealing elements

Claims

1. Guiding device (1) for a sliding element (10), such as a sliding door provided with a door leaf (11), with which a room opening (9) of a building part (90) can be closed at least approximately tightly, with a running rail (4) having a longitudinal axis (x), and with at least two carriages (3A, 3B) guided along a running rail (4), each having a carriage body (33) that is connected to a coupling device (2) that is coupled or can be coupled with the sliding element (10),

wherein the running rail (4) comprises at least two rail segments (4A, 4B) arranged one behind the other and supporting each one of the carriages (3A, 3B);

wherein each rail segment (4A, 4B) comprises an angular part with a first track (41) on one side of the angular part and a second track (41, 42) on the other side of the angular part, which first and a second track (41, 42) run in parallel and that are inclined towards one another;

wherein each carriage body (33) holds at least two first and at least two second running elements (31; 32) that are inclined towards one another and that are supported by the corresponding first or second track (41; 42) and between which the angular part of the corresponding rail segment (4A, 4B) is held below the carriage (3A or 3B),

whereby at least one of said first and second tracks (41, 42) comprises a first track section (411; 421) running in parallel to the longitudinal axis (x) and a second track

section (412; 422), along which the carriage (3) can be driven into a terminal position, running inclined to the longitudinal axis (x);

wherein each carriage body (33) comprises on one side a wing element (331) with a pivot (25), which pivotally holds the coupling device (2), and

wherein the coupling device (2) is holding a connecting element (23), on which the sliding element (10) can be mounted, below the carriage (3A, 3B).

2. Guiding device (1) according to claim 1, **characterised in that** the running rail (4), above or below of the sliding element (10),

a) is connected directly to the building part (90), or

b) is held in a mounting profile (7), or

c) is arranged in a building channel (910).

3. Guiding device (1) according to claim 2, **characterised in that** the carriage body (33) comprises a first wheel channel (310), in which one or two first running elements (31) are held and a second wheel channel (320), in which one or two second running elements (32) are held.

4. Guiding device (1) according to claim 3, **characterised in that** the first and second running elements (31, 32) are track rollers, that the first track rollers (31), which are aligned in parallel to the and are seated on the first track (41), are held by first shafts (331) that are extending from the carriage body (33) or that are held in the first wheel channel (310), and that the second track

rollers (32), which are aligned in parallel to the and are seated on the second track (42), are held by second shafts (332) that are extending from the carriage body (33) or that are held in the second wheel channel (320).

5. Guiding device (1) according to one of the claims 1 - 4, **characterised in that** the coupling device (2) is arranged below or above of the carriage body (33).

6. Guiding device (1) according to one of the claims 1 - 5, **characterised in that** the at least two rail segments (4A, 4B) are held by the mounting profile (7) or are unitary connected with one another.

7. Guiding device (1) according to claim 6, **characterised in that** the first and second track are directed towards the ceiling and that the first track (41) is inclined relative to the vertical line (s) with an angle in the range of 22.5° - 90° or that the first and the second track (41, 42) of the running rail (4) enclose an angle of at least approximately 90°.

8. Guiding device (1) according to one claim 6 or 7, **characterised in that** the running rail (4) or the rail segments (4A, 4B) comprises a common first track (41A, 41B) and an individual second track (42A, 42B) for each of the carriages (3A, 3B), which second tracks (42A, 42B) are arranged side by side or behind one another.

9. Guiding device (1) according to one of the claims 1 - 8, **characterised in that** the inclination of the second track section (412) versus the first track section (411) of the first track (41) and/or the inclination of the second track section (422) versus the first track section (421)

of the second track (42) are selected in such a way, that the sliding element (10), within a closing path (Sxc) that corresponds to the length of the second track section (422), traverses on the one hand a distance (Sy) between the front side of the sliding element (10) and the frame (911) of the room opening (9) and on the other hand a distance (Sz) between the lower side of the sliding element (10) and the floor (92) bordering the room opening (9).

10. Guiding device (1) according to one of the claims 1 - 9, **characterised in that** a guide rail (6) is provided on the side of the sliding element (10) that is opposite to the side of the sliding element (10) where the running rail (4) is installed, which guide rail (6) slidably holds at least one guide carriage (5, 5A, 5B) that is connected to the sliding element (10) and which guide rail (6) comprises a first guide segment (61) that runs in parallel to the first track section (411; 421) of the running rail (4) and a second guide segment (62) that runs at least approximately in parallel to the second track section (412; 422) of the running rail (4).

11. Guiding device (1) according to one of the claims 1 - 10, **characterised in that** the front side (111) of the sliding element (10) facing the room opening (9) or the edge (91, 93) of the room opening (9) is provided at least partially with a sealing gasket (12), which in the closing position of the sliding element (10) is held between the sliding element (10) and the edge (91) of the room opening (9) or a limiting strip (93).

12. Guiding device (1) according to claim 11, **characterised in that** the sealing gasket (12) consists of one or a plurality segments or that the sealing gasket (12) forms a closed loop.