(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 779 406 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.06.1997 Bulletin 1997/25

(51) Int. Cl.[6]: **E05D 15/10**

(21) Application number: **96120047.4**

(22) Date of filing: **13.12.1996**

(84) Designated Contracting States:
CH DE ES FR GB IT LI SE

(30) Priority: **14.12.1995 IT TO951010**

(71) Applicant: **De Poli, Pietro**
10098 Rivoli, Torino (IT)

(72) Inventor: **De Poli, Pietro**
10098 Rivoli, Torino (IT)

(74) Representative: **Aprà, Mario**
Aprà Brevetti
Via Bertola 2
10121 Torino (IT)

(54) Sliding device for frames, panels and the like, such as wings of doors, windows and pieces of furniture

(57) The sliding system according to the invention comprises ball runner means (21-23) and corresponding track means (17.1, 17.2) in which said ball runner means are engaged so as to roll freely, one of these means being mounted (e.g. by means of a fastening member 19.1) to a sliding structure, such as a sliding door or sash, e.g. for a door or window opening, piece of furniture or vehicle, while the other of these means is mounted on a fixed structure (14), e.g. a door or window opening, piece of furniture or vehicle, or vice versa.

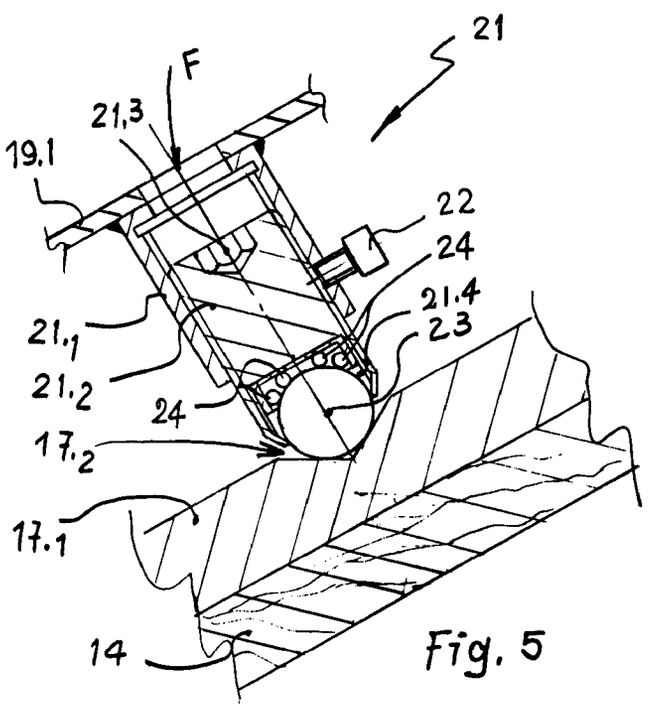


Fig. 5

EP 0 779 406 A1

Description

The present invention relates to a sliding system for frames, panels and the like, such as sliding doors and sashes for door and window openings and furniture.

The field of application of this invention includes, for example, the furniture industry, the door and window industry and the vehicle industry, where the problem arises of how selectively to close and open voids or openings with corresponding sliding panels or frames, such as sliding doors or sashes for example.

A sliding door or sliding sash is conventionally supported relative to the fixed structure of a piece of furniture, or to the frame of a door or window opening or to the bodywork of a vehicle, by sliding means in the form of rotating wheels or rollers mounted on, for example, the sliding structure, while corresponding track means for the rollers or wheels are fitted on, for example, the fixed structure of the piece of furniture, frame or bodywork.

This known arrangement, however, cannot be used where a sliding door or sliding sash is to follow paths including sudden changes of direction such as more or less short radii of curvature, or twisting paths, and this greatly restricts the field of application of sliding doors and sashes.

In particular, the known runner systems for sliding doors and the like in practice only use virtually straight tracks, which means that the corresponding doors or sashes can be formed only by flat panels or frames.

Moreover, in certain specific applications, as for instance doors or sashes that slide behind each other for opening furniture or the like, the abovementioned restriction makes it necessary to use complicated sliding arrangements in order to enable the doors or sashes to be moved in directions that diverge substantially from the rectilinear tracks.

Again, the structural complexity of known sliding systems for doors and sashes and the like cannot be used to install sliding doors to close voids such as built-in wardrobes, as they are known, without having sliding members on the outside of these voids.

Taking as its starting point the problems outlined above, this invention seeks to eliminate them.

In particular, one object of this invention is to provide a sliding system for frames, panels and the like, such as sliding doors and sashes for door and window openings and furniture that will allow each door or sash to be slid along paths following variable directions, even with relatively short radii of curvature and twisting paths.

Another object is to provide a sliding system as specified that can even be used with non-rectilinear tracks and hence also with panels or frames that are not flat.

A further object is to provide a sliding system as indicated that is structurally simple and functionally convenient, reliable and efficient.

Yet another object is to provide a sliding system as stated above that will enable the installing of sliding doors or sashes or the like to completely close off a void, such as a built-in wardrobe, avoiding the presence of external sliding members outside the void.

In the light of these objects, this invention provides a sliding system for frames, panels and the like, such as sliding doors and sashes for door and window openings and furniture, whose essential characteristics form the subject of the main claim, which should be regarded as reproduced here in its entirety.

Other advantageous features will be found in the subordinate claims, which should likewise be regarded as reproduced here in their entirety.

This invention is described in detail below with reference to the attached drawings, provided purely by way of non-restrictive examples, in which:

- Fig. 1 is a front elevation of a wardrobe comprising a generally parallelepipedal body with two sliding doors and incorporates the sliding system in a first illustrative embodiment of the present invention;
- Figures 2 and 3 are plan views from above and below, respectively, in the direction of arrows II and III as marked in Fig. 1;
- Fig. 4 is a sectional view on IV-IV as marked in Fig. 1;
- Figures 5 and 6 are detail drawings in section and on a larger scale, respectively, on V-V and VI-VI as marked in Fig. 2;
- Fig. 7 shows an alternative embodiment of ball runner means according to the present invention;
- Fig. 8 is an elevation of a wardrobe having an essentially cylindrical body and a single sliding door, incorporating the sliding system in a second illustrative embodiment of the present invention;
- Figures 9 and 10 are plan views from above and from below, respectively, in the direction of arrows IX and X as marked in Fig. 8;
- Fig. 11 is a detail drawing in section and on a larger scale on XI-XI as marked in Fig. 10;
- Fig. 12 is a detail drawing in section and on a larger scale on XII-XII as marked in Fig. 9;
- Fig. 13 is an elevation of a wardrobe or cupboard having an essentially cylindrical body and with a composite door, in an alternative embodiment of the invention;
- Figures 14 and 15 are plan views from above and below, respectively, in the direction of arrows XIV and XV as marked in Fig. 13;
- Fig. 16 is an elevation of a sliding structure, for example for a window opening, that can be slid relative to a frame structure using the sliding system in a third illustrative embodiment of the present invention;
- Fig. 17 is a front elevation of a wardrobe or cupboard with an essentially parallelepipedal body and two doors, incorporating the sliding system in a fourth illustrative embodiment of the present invention, said doors being shown side by side such that the void of the wardrobe or cupboard is closed;

- Figures 18, 19 and 20 are sectional views on XVIII-XVIII, XIX-XIX and XX-XX, respectively, as marked in Fig. 17;
- Figures 21 to 24 are detail drawings on a larger scale and in section respectively on XXI-XXI, XXII-XXII, XXIII-XXIII and XXIV-XXIV as marked in Fig. 18;
- Fig. 25 is a detail drawing, on a larger scale, showing the detail marked XXV in Fig. 18;
- Fig. 26 is a sectional view on XXVI-XXVI as marked in Fig. 25;
- Fig. 27 is a similar view to Fig. 17, in which however the doors are shown one behind the other so that the void of the wardrobe or cupboard is open; and
- Fig. 28 is a sectional view on XXVIII-XXVIII as marked in Fig. 27.

- First embodiment

Referring initially to Figures 1 to 6, the numeral 10 (Fig. 1) indicates a wardrobe or cupboard having two sliding doors which are superimposed when the wardrobe or cupboard is open and consist of flat panels 11 and 12.

Said wardrobe or cupboard 10 comprises a box structure made up of lateral panels or vertical sides 13, a horizontal top panel 14, a horizontal base panel or bottom 15 which is raised above the floor, and a vertical rear or back panel 16.

It will be observed, in particular, that the sides 13 extend forwards, upwards and downwards beyond the other panels of the fixed structure of the wardrobe 10.

Fixed to the top panel 14 are track means 17 (Fig. 2) consisting of a plate 17.1, which may be of metal, in which two tracks or channels 17.2 of an essentially "V" cross section are formed, for example by milling, open side uppermost.

Fixed to the underside of the bottom panel 15 (Fig. 3) are track means 18 that likewise consist of a plate 18.1, which may be of metal, in which two tracks or channels 18.2 of an essentially "V" cross section are formed, for example by milling, open side uppermost.

Slotted holes 17.3, 18.3 enable said plates 17.1 18.1, to be fixed to their respective supporting panels 14, 15 with corresponding nuts and bolts B, such that adjustments are possible (cp. Fig. 6).

The two channels 17.2 of the track means 17, and the two channels 18.2 of the track means 18, are staggered in the direction of the depth of the wardrobe or cupboard 10, and comprise respective rectilinear intermediate sections 17.21, 18.21 running lengthwise with reference to the corresponding supporting panel 14, 15. The length of each lengthwise section of channel 17.21, 18.21 is approximately equal to the width of a corresponding sliding door or sash 11, 12. Said lengthwise sections 17.21, 18.21 of the track channels 17.2, 18.2 lie mostly on opposite sides of the vertical transverse mid-plane of the wardrobe 10 (this plane is orthogonal to the back, base and top panels 16, 15 and 14 respectively), but also extend adjacent to each other a short way beyond this mid-plane.

The lengthwise section 17.21, 18.21 of each track channel 17.2, 18.2 is extended at its ends by respective short end sections, also rectilinear, 17.22 and 18.22 respectively, but connected at an angle alpha (= approximately 120°, Fig. 2) and oriented in opposite directions. The end sections 17.2, 18.22 of the track channels 17.21, 18.21 in the vicinity of said vertical mid-plane are oriented in opposite directions, that is to say one running forwards and the other towards the back of the wardrobe 10.

It will be observed that the arrangement of the track channels 17.2 and track channels 18.2 is in mirror symmetry about a horizontal plane of symmetry dividing the wardrobe or cupboard 10.

The sliding door or sash 11 is provided with four generally L-shaped metal supporting brackets 19 each attached by its vertical arm close to the four corners of its inside face, in such a way that each presents a horizontal arm 19.1 approximately flush with the corresponding peripheral edge of the door or sash.

Furthermore the sliding door or sash 12 is also provided with four generally L-shaped metal brackets 20 each attached by its vertical arm close to the four corners of its inside face, in such a way that the horizontal arm 20.1 of each of said brackets is set back from the corresponding peripheral edge of the door or sash by a height slightly greater than the thickness of the horizontal arms 19.1 of the brackets 19 of the other door or sash 11 (cp. Fig. 4).

It will be observed that within each pair of brackets 19, whether upper or lower, the arms 19.1 are of unequal length, those closest to said vertical mid-plane being longer. Likewise within each pair of brackets 20, whether upper or lower, the arms 20.1 are of unequal length, the arms 20.1 closer to said vertical mid-plane being shorter.

Moreover the arms 19.1 of the brackets 19 project noticeably further towards the back 16 of the wardrobe or cupboard than do the arms 20.1 of the brackets 20.

Said horizontal arms 19.1, 20.1 of the brackets 19, 20 each support ball runner means 21 at their free ends.

As illustrated in detail in Fig. 5, said ball runner means 21 comprise a metal outer case 21.1 shaped like a cylindrical cup and fixed by its inner end wall on an approximately vertical axis to the horizontal arm (19.1 or 20.1) of a bracket (19 or 20). Said case 21.1 has an axial hole in its inner end and is internally threaded. Engaged helically in this thread is a metal cylinder 21.2 which carries the ball and is correspondingly externally threaded. The horizontal arm (19.1 or 20.1) of the bracket that supports said ball runner means 21 contains a through hole F on the same axis as the hole of the case 21.1, while the ball-carrier cylinder 21.2 contains, in line with said hole F, an axial cavity 21.3 for an Allen key.

A set screw 22 screwed into a correspondingly tapped radial through hole in the case 21.1 presses

against the ball-carrier cylinder 21.2 with its tip to lock it in position with respect to this case.

The axial end of the ball-carrier cylinder 21.2 nearest the track means 17 or 18 contains an axial cavity 21.4 that partially houses a ball 23 made of, for example, Teflon (registered trademark) which is free to roll in all directions and rolls freely in a corresponding track channel 17.2 or 18.2.

To facilitate the free rolling of the ball 23, the latter rests on a bed, inside the cavity 21.4 of the ball-carrier cylinder 21.2, of freely revolving ball bearings 24 of much smaller diameter: these are housed in said cavity 21.4 behind the ball 23.

It will be observed that the two balls 23 of the ball runner means 21 mounted on both upper brackets 19 of the sliding door or sash 11 engage in a respective track channel 17.2 of the upper track means 17.

In the same way both balls 23 of the ball runner means 21 mounted on the two upper brackets 20 of the sliding door or sash 12 engage in a respective track channel 17.2 of the upper track means 17.

Similarly, both balls 23 of the ball runner means 21 mounted on the two lower brackets 19 of the sliding door or sash 11 engage in a respective track channel 18.2 of the lower track means 18.

In the same way, both balls 23 of the ball runner means 21 mounted on the two lower brackets 20 of the sliding door or sash 12 each engage in a respective track channel 18.2 of the lower track means 18.

It will be seen in particular that, in the rest position illustrated in the drawings (in which the doors or sashes of the cupboard are side by side, i.e. closed and coplanar), the balls 23 mounted on the sliding door or sash 11 occupy the end sections 17.22, 18.22 of the track channels that extend towards the back 16 of the cupboard, while the balls 23 mounted on the sliding door or sash 12 occupy the end sections 17.22, 18.22 of the track channels that extend towards the front of the cupboard 10, i.e. towards the door or sash itself.

It will be seen too that the length and inclination (angle alpha) of the end sections 17.22, 18.22 of the track channels 17.2, 18.2 are such that the sliding doors 11, 12 can be opened one against the other by (a) sliding the door 11 forwards on the balls 23 over the door 12, in such a way that it comes away from the back 16, and/or (b) sliding the door 12 back in on the balls 23 behind the door 11, in such a way that it moves towards the back 16. The subsequent relative sliding of said doors or sashes 11, 12 on the balls 23 along the intermediate sections of channel 17.21, 18.21 in a staggered arrangement on respective parallel vertical planes takes place without mutual interference, with the result that said doors or sashes 11, 12 are superimposed upon each other with the cupboard 10 open, having started from their side-by-side arrangement with the cupboard closed.

It will also be seen that during the sliding of the doors or sashes 11 and 12, their respective brackets 19 and 20 and associated ball roller means 21 do not interfere with each other, being staggered both in height and in depth.

By reversing this process the cupboard 10 is closed, leaving said doors or sashes 11, 12 side by side in the same plane as each other.

This process is made possible by the ability of the balls 23 to orient through 360° as they rotate freely in their respective ball-carrier seats 21.4 guided by the track channels 17.2, 18.2. Their ability to be thus orientated enables the balls 23 to be rolled smoothly even in the connecting portions where the radius of curvature between the angled sections 17.21/17.22 and 18.21/18.22 of the tracks 17, 18 is short.

Assembly of the sliding doors or sashes 11, 12 is carried out as follows:

With the set screws 22 slack, the ball-carrier cylinders 21.2 are retracted along their threads into their respective cases 21.1.

The doors or sashes 11, 12 are then erected by placing the balls 23 of the upper brackets 19, 20 in rolling engagement in the upper track channels 17.2, while the balls 23 of the lower brackets 19, 20 are kept at a distance from their respective lower track channels 18.2.

Then, by screwing out the ball-carrier bodies 21.2 relative to their cases 21.1, the balls 23 of the lower brackets 19, 20 are also dropped into rolling engagement with their corresponding lower track channels 18.2. This ensures correct and stable assembly of the doors or sashes 11, 12. Lastly, the set screws 22 are tightened up.

- Alternative embodiment

Fig. 7 illustrates an alternative embodiment of the ball runner means, here marked 30 and comprising a metal case 31 shaped like a cylindrical cup and fixed by its inner end wall 31.1 and on an orthogonal axis relative to a horizontal bracket arm 19.1 or 20.1 (not illustrated), with its opening towards the corresponding track means 17 or 18 (also not illustrated). Said case 31 is internally threaded towards the inner end 31.1 and carries an internal moveable cap 32 with a corresponding external thread in helical engagement. In the inner end 31.1 of the case 31 is an axial through hole 31.2 corresponding to a through hole in the bracket arm to which the case is fixed, while a corresponding axial cavity 32.1 for an Allen key is provided in said cap 32.

A metal ball-carrier cylinder 33 is partly housed in said case 31 with the ability to slide axially between two coaxial internal elastic rings 31.3, 31.4, which limit its axial travel between a position of maximum extension and one of minimum extension relative to the case 31. A helical compression spring 36 is fitted between said cylinder 33 and the moveable cap 32 in order to apply an adjustable elastic preload to this cylinder.

Said ball-carrier cylinder 33 has an axial cavity 33.1 on its end nearer to the track means 17 or 18, and this partly houses a ball 34 made of, for example, Teflon and

free to roll in all directions against a bed of smaller-diameter free-rolling ball bearings 35 situated between the ball and the inside surface of said cavity 33.1. Said ball 34 is in free rolling engagement with a corresponding track channel 17.2, 18.2 (not shown) as described above with reference to Figures 1 to 6 of the drawings. This disposition will, for example, make assembling the sliding doors or sashes easier and provides spring-loaded support for these doors or sashes relative to the fixed structure of the cupboard or the like.

- Second embodiment

With reference now to Figures 8 to 12, the numeral 40 indicates a wardrobe or cupboard having a generally cylindrical body. The body of the cupboard 40 is raised above the floor on a cylindrical foot 40.1 of reduced diameter.

The side wall of said cupboard 40 contains an opening 40.2 with an angular amplitude of about 90° which can be closed by an external sliding door 41 consisting of a panel with a corresponding curved profile. Said door 41 extends beyond the cupboard body 40 at the top and bottom.

Upper 42 and lower 43 track means are fixed respectively to the upper face of the top wall 40.3 and to the lower face of the bottom wall 40.4 of said cupboard body 40. Said track means 42, 43 comprise respective metal channel tracks 42.1, 43.1, each extending through about 270° of an arc of a circle which is concentric with the corresponding top or bottom wall. Said tracks 42.1, 43.1 are in mirror symmetry about a vertical mid-plane passing through the axis of the cupboard body 40 and dividing said opening 40.2 into two halves. Fixing eyeholes 42.2, 43.2 integral with said tracks 42.1, 43.1 (cp. Fig. 12), enable corresponding fastening bolts B1 to fix the tracks to the corresponding top and bottom walls of the cupboard 40 in an adjustable manner.

A generally L-shaped metal supporting bracket 44 is fixed at the top by its vertical arm to the inside face of said sliding door 41, in such a way that its other arm 44.1 is horizontal and approximately flush with the horizontal top edge of the perimeter of this door. Said bracket 44 is fixed in mirror symmetry with respect to the vertical mid-plane of the door itself, passing through the axis of the cupboard body 40.

Fixed to said supporting bracket 44 are ball runner means 44.1 exactly similar in structure and arrangement to the ball runner means illustrated and described with reference to Figures 1 to 7, and therefore not further described here. In this way said door 41 is integral with a freely rolling ball engaged in said upper channel track 42.1. It will be observed that the centre of this ball is contained in said vertical mid-plane of the door 41.

Two generally L-shaped lower metal supporting brackets 45 are fixed by their vertical arm to the inside face of said sliding door 41, one in each lower corner of the door, so that their other arm 45.1 is horizontal and approximately flush with the bottom horizontal edge of the perimeter of said door.

Fixed to each bracket 45 is a rigid vertical metal pin 46 that is generally cylindrical and has a hemispherical head engaged, with low friction, by way of a shoe, in the lower channel track 43.1.

By means of the abovementioned arrangement, the door 41 has the support to slide smoothly around a wide arc of circumference relative to the body of the cupboard 40 with a reliable and accurate action, and can be rotated about the axis of the cupboard body equally well in both directions of rotation so as to reveal the opening 40.2 or close it.

For the method of fitting the door 41, see the explanation given with reference to Figures 1 to 6.

- Alternative embodiment

Figures 13 to 15 show an alternative to the abovementioned second embodiment of the invention, with similar parts - which will not be further described - carrying the same reference numerals.

As an alternative to the version shown in Figures 8 to 12, the door or sash 41 has two upper brackets 44, one in the vicinity of each upper corner, and corresponding ball runner means 44.1, the balls of which are in free rolling engagement in the upper channel guide 42.1.

In addition to this, said sliding door 41 is hinged on one edge, by means of cylindrical hinges 50 on a vertical axis, to another door 51 that can pivot freely about said axis.

With this arrangement it is possible to combine the advantages of the sliding door 41 with those of the swing door 51.

- Third embodiment

Shown in Fig. 16 is a third embodiment of the present invention, in which a sliding door or sash 60, consisting of a flat door or window frame, slides relative to a frame 61 on two parallel rectilinear tracks, a bottom track 62.1 and an upper track 62.2.

Said door or sash 60 slides relative to said tracks 62.1, 62.2 by means of an arrangement of four ball runner means 63 - two at the top and two at the bottom - fixed to the door itself, with respective balls 64 in free rolling engagement in the tracks.

This arrangement provides smooth, regular sliding of the door or sash 60 relative to the frame 61 using structurally simple and functionally reliable means.

- Fourth embodiment

With reference to Figures 17 to 28, the numeral 110 (Fig. 17) indicates a wardrobe or cupboard having two sliding doors that are superimposed on each other when open and consist of two identical flat panels 111 and 112.

Said wardrobe or cupboard 110 comprises a fixed

box structure made up of lateral panels or vertical sides 113, a horizontal top panel 114, a horizontal base panel or bottom 115 and a vertical rear or back panel 116.

Fixed to the horizontal face 114.1 of the top panel 114, inside the cupboard, are horizontal upper track means 117 (Fig. 19) consisting of a plate 117.1, in synthetic resin or metal for example, in which a channel track 117.2 with a generally "V" cross section is formed, for example by milling, with its open side down.

Fixed to the horizontal face 115.1 of the bottom panel 115, inside the cupboard, are horizontal lower track means 118 (Fig. 18) that also consist of a plate 118.1, in synthetic resin or metal for example, in which a channel track 118.2 with a generally "V" cross section is formed, for example by milling, open side uppermost.

The two horizontal tracks 117.2, 118.2 are in mirror symmetry relative to a horizontal plane dividing the cupboard 110.

Said two horizontal tracks, upper 117.2 and lower 118.2, comprise respective rectilinear sections 117.21, 118.21 that extend lengthwise along a substantial portion of the corresponding plates 117.1, 118.1. Said lengthwise sections 117.21, 118.21 of the tracks 117.2, 118.2 are lined up in the same vertical plane parallel with the back panel 116 of the cupboard, and are set back from the front lengthwise edges (i.e. remote from said panel 116) of the top and bottom panels 114 and 115, respectively, by a distance equal to more than twice the thickness of each sliding door or sash 111, 112.

At each end, respective end branches 117.22, 118.22 continue these lengthwise sections 117.21, 118.21 of the tracks 117.2, 118.2 in a diverging direction towards the front lengthwise edge of the top and bottom panels 114, 115, in such a way as to form angles beta with these lengthwise sections of about 140° (Figs. 18, 19). These end branches 117.22, 118.22 end at a distance from the sides 113 of the wardrobe or cupboard 110 and are in mirror symmetry about the transverse vertical mid-plane of the wardrobe or cupboard.

Two intermediate arms 117.23, 118.23 are additionally provided in each track 117.2, 118.2 close to and in mirror symmetry either side of said transverse vertical mid-plane. Each intermediate branch 117.23, 118.23 is approximately parallel with and the same length as the end branch 117.22, 118.22 to which it is nearest in the same track 117.2, 118.2 and it too extends towards the front lengthwise edge of the top and bottom panels 114, 115.

Each sliding door or sash 111,112 is supported so as to slide relative to the upper track 117.2 and lower track 118.2 by an arrangement of respective pairs of ball runner means 120. More specifically, ball runner means 120 are fixed in the vicinity of each corner of each door or sash 111, 112 (Figs. 18, 19) on a respective metal supporting bracket 122 mounted on the door or sash and rigidly attached close to the upper or lower side edge.

Said ball runner means 120 consist (Fig. 24) of a cupped body 120.1, the open side of which is towards the opposing track 117.2 or 118.2; it houses a bowl 120.2 that is axially adjustable using an axial screw means 120.3 fixed to this bowl and engaged in a corresponding tapped hole 120.4 provided in the inner end of the cupped body 120.1.

The bowl 120.2 contains a hemispherical seat whose open side is towards the opposing track 117.2 or 118.2 and in which a corresponding ball 121 is housed so as to rotate freely as it is guided along a corresponding track 117.2 or 118.2.

In addition, each of the four metal supporting brackets 122, which, when the doors or sashes are closed, are situated close to said vertical mid-plane, supports an idle roller 123 on an approximately vertical axis closer to this vertical mid-plane than the adjacent ball runner means 120 in the same bracket. Said four rollers 123 (here consisting of four ball-type rolling bearings) - when seen in plan view - have their outer circumferential edge projecting beyond their supporting brackets 122 and towards the interior of the void of the piece of furniture 110, whereas said supporting ball means 120 are contained within the outline of their brackets.

In addition, the two rollers 123 adjacent to the same track 117.2 or 118.2 are staggered in height relative to this track, in such a manner as to move with their respective doors or sashes at heights that do not interfere with each other. With reference to Figures 22 to 25, the roller 123 mounted on the lower bracket 122 of the door or sash 111 is positioned closer to the track 118.2 than the adjacent roller 123 mounted on the lower bracket 122 of the door or sash 112, so that the rollers are moved translationally with their respective doors or sashes at different heights and along paths that do not interfere with each other.

In addition, vertical barrier means, both at the top 124 and bottom 125 (Fig. 27), are fixed to the respective top 114 and bottom 115 panels and extend on either side of said vertical mid-plane. Said top 124 and bottom 125 barrier means are fixed near the respective tracks 117.2, 118.2, on the inward side of the void of the cupboard or wardrobe 110.

Said barrier means 124, 125 each comprise a metal body 126 of a general "L" shape (viewed in side elevation, Fig. 22), whose horizontal leg 126.1 provides a base fixed to the corresponding top or bottom panel 114 or 115 respectively, while the vertical leg 126.2 of said metal body 126 provides a vertical barrier with two arms 126.21, 126.22 extending in opposite directions and at different heights relative to the adjacent track 117.2 or 118.2; that is to say (with reference to Figures 22-26), barrier arm 126.21 is situated at a height corresponding to the height at which the roller 123 mounted on the lower bracket of the door or sash 111 travels, and barrier arm 126.22 is situated at a height corresponding to the height at which the roller 123 mounted on the lower bracket of the door or sash 112 travels.

Moreover each arm 126.21, 126.22 of the barrier is slightly bent at its free end towards its respective roller

123, so as to lead the roller in to the barrier. In particular, said lead-in ends of the arms 126.21, 126.22 are situated on the path followed by the respective idle rollers 123 mounted on the corresponding door or sash 111 or 112, when the balls 121 mounted on this door or sash roll along the branches of the tracks 117.2, 118.2.

By means of the abovementioned arrangement, when the balls 121 of one sliding door or sash 111 or 112 reach the end of their travel and enter the end sections 117.22, 118.22 and intermediate sections 117.23, 118.23 of the tracks 117.2, 118.2, which lie on one side of said transverse vertical mid-plane, while the balls 121 mounted on the other sliding door or sash 112 or 111 reach the end of their travel and enter the end sections 117.22, 118.22 and intermediate sections 117.23, 118.23 of the tracks 117.2, 118.2, which lie on the other side of said vertical mid-plane, then the sliding doors or sashes 111, 112 are side by side and the void of the wardrobe or cupboard 10 is closed (Fig. 17). In this condition the vertical edges of the doors or sashes 111, 112 are juxtaposed, on one side, on the vertical edges 113 of the wardrobe or cupboard and, on the other side, on each other, while the doors or sashes themselves are parallel to the back panel 116 and their front faces are flush with the front lateral edge of the vertical edges 113 and of the top and bottom panels 114, 115 of the wardrobe or cupboard 110.

When, however, the balls 121 mounted on one or other door or sash 111 or 112 reach the end of their travel and enter the end sections 117.22, 118.22 and intermediate sections 117.23, 118.23 of the tracks 117.2, 118.2, which lie on one side of said transverse vertical mid-plane, while the balls mounted on the other door or sash 112 or 111 enter the rectilinear section 117.21, 118.21 of the tracks 117.2, 118.2, then the latter door or sash can be run in to the open position of the void of the wardrobe or cupboard 110, finally disappearing behind the first door or sash (Fig. 27). In this condition there is a free space, however, between the two superimposed doors or sashes sufficient for there to be no rubbing between the idle rollers 123 projecting inwards from the brackets 122 of the first door or sash and the front face of the other door or sash.

In order to move one of the two sliding doors or sashes 111 or 112 from the closed to the open condition of the void of the wardrobe or cupboard 110, the user simply pushes it into the wardrobe or cupboard, so that its balls 121 travel correspondingly inwards by rolling along the end sections 117.22, 118.22 and intermediate sections 117.23, 118.23 of the tracks 117.2, 118.2 towards the lengthwise section 117.21, 118.21 of the tracks.

The inclination of said branches (angle beta) relative to the rectilinear sections 117.21, 118.21 of the tracks, on a path that converges from the outside towards the inside of the void of the wardrobe or cupboard 110 and in mirror symmetry about said transverse vertical mid-plane, encourages continuity of sliding of the door or sash when pushed, because its balls 121 are helped in following the change of direction of the tracks 117.2, 118.2 between their branches and said rectilinear section.

Furthermore, as said balls 121 travel towards the inside of the cupboard, the idle rollers 123 mounted on the moving door come into dynamic rolling contact with the respective vertical arms 126.21 or 126.22 of the top and bottom barriers 124 and 125, respectively, which accompany, and forcibly bring about, a sudden change of direction of the balls 121 and, therefore, of the corresponding door or sash 111 or 112, between said branches 117.22, 118.22 and 117.23, 118.23 and the subsequent rectilinear section 117.21, 118.21 of the tracks 117.2, 118.2.

It should be noted that the barrier arms that act on the idle rollers mounted on the door or sash that is not being moved do not interfere with the idle rollers mounted on the door or sash that is being moved, because of their different heights relative to the tracks.

By reversing the procedure it is possible to move one of the two sliding doors or sashes 111 or 112 from the open to the closed condition of the void of the wardrobe or cupboard 110.

Naturally, many variants may in practice be made of the embodiments described and illustrated purely by way of non-restrictive examples.

For example, the structure, form and materials of the tracks, of the ball runner means and of any connecting brackets that may be used between sliding frames or panels and said ball roller means may be altered.

It should be noted that the expression: "frames, panels and the like" refers here to any flat or spatial structure with a rectilinear, curvilinear or composite profile that is supported in such a way that it can slide with respect to any fixed structure.

At the same time, the path followed by the tracks may with equal ease be rectilinear, curvilinear, mixed and/or twisting.

Also, a panel may be supported so as to allow sliding between two arrangements of track means, e.g. a top track and a bottom track, on ball runner means engaged so as to be able to roll freely in only one of said arrangements of track means, for example the top track, while the other arrangement of track means receives runner means in the form of shoes, wheels, rollers or the like mounted on the same door.

It goes without saying that ball runner means may, in a variant, be made integral with a fixed structure of a piece of furniture, or with the frame of a door or window opening or with the bodywork of a vehicle, while corresponding track means are made integral with the sliding frame or panel.

Claims

1. Sliding system for frames, panels and the like, such as sliding doors and sashes for door and window openings and furniture, the system being characterized in that it comprises ball runner means (21-23;

30-34; 120, 121) and corresponding track means (17, 18; 42, 43; 62.1, 62.2; 117, 118), in which said ball runner means are engaged so as to roll freely, one of these means being mounted on a sliding structure (11, 12; 41; 60; 111, 112) forming the door or sash of, for example, a door or window opening, piece of furniture or vehicle, while the other of these means is mounted on a fixed structure (14, 15; 40.3, 40.4; 61; 114, 115), for example a door or window opening, piece of furniture or vehicle, or vice versa.

2. Sliding system according to Claim 1, characterized in that said ball runner means (21-23; 30-34; 120, 121) comprise ball-carrier means (21; 30; 120) that partially house at least one ball (23; 34; 121) able to roll freely in all directions and engaged so as to roll freely in said corresponding track means (17, 18; 42, 43; 62.1, 62.2; 117, 118).

3. Sliding system according to Claim 2, characterized in that said sliding ball means (21-23, 30-34) contain an arrangement of free-rolling ball bearings (24; 35) interposed between said at least one ball (23, 34) and said ball-carrier means (21; 30).

4. Sliding system according to Claim 2 or 3, characterized in that said ball-carrier means (21; 30; 120) comprise a ball-carrier body (21.2; 33; 120.2) which is adjustable relative to supporting means (19, 20, 21.1; 31; 120.1), e.g. for correct relative positioning between the ball (23; 34; 121) and the corresponding track means (17, 18; 42, 43; 62.1, 62.2; 117, 118).

5. Sliding system according to Claim 2, characterized in that there are arranged in said ball-carrier means (30), for example between a ball-carrier body (33) and supporting means (31), elastic means (36) that apply an elastic preload on said at least one ball (34).

6. Sliding system according to Claim 1, characterized in that said track means (17, 18; 42, 43; 62.1, 62.2; 117, 118) comprise rectilinear tracks (62.1, 62.2), curvilinear tracks (42.1, 43.1) and/or mixed and/or twisting tracks (17.2, 18.2; 117.2, 118.2).

7. Sliding system according to one or more of the previous claims, characterized in that it comprises two arrangements of said track means (17.2, 18.2; 42.1, 43.1; 62.1, 62.2; 117.2, 118.2), e.g. in mirror symmetry about a horizontal plane of symmetry, and also ball runner means (21-23; 30-34; 120, 121) engaged so as to roll freely in at least one of said arrangements of track means.

8. Sliding system according to Claim 7, characterized in that low-friction runner means (45, 46), e.g. a shoe, or rotating runner means, e.g. a wheel, roller or the like, are engaged in one (43.1) of said arrangements of track means (42.1, 43.1).

9. Sliding system according to one or more of the previous claims, in which at least two sliding doors or sashes (11, 12) are arranged to slide relative to a fixed structure (10) between a closed arrangement and an open arrangement of a void in said fixed structure, the system being characterized in that it comprises track means (17, 18) including at least two tracks (17.2, 18.2) extending along the running direction - each for a length (17.21, 18.21) at least equal to the width of each of said sliding doors or sashes or the like - , which tracks are staggered in a direction which may for example be orthogonal to said running direction, and are partly adjacent, each track having respective end sections (17.22, 18.22) oriented in divergent direction relative to said running direction and in mutually opposite directions, the neighbouring end sections of said tracks being also oriented in mutually opposite directions, and comprises in addition at least one pair of ball runner means (21; 30) for each sliding door or sash (11, 12), each runner means being engaged so as to roll freely in one of said partly adjacent tracks (17.2, 18.2), and in that at the end of their travel the ball runner means of one sliding door or sash engage in the end sections of said tracks where they both point in the same direction, whereas the ball runner means of the other sliding door or sash engage, at the end of their travel, in the end sections of said tracks where they point in the opposite direction, in such a way that said void is opened when said sliding doors or sashes are superimposed on each other, and closed when these doors or sashes are side by side in the same plane.

10. Sliding system according to one or more of Claims 1 to 8, in which at least two sliding doors or sashes (111, 112) can be moved relative to a fixed structure (110) between a closed arrangement and an open arrangement revealing a void in said fixed structure, the system being characterized in that it comprises track means (117, 118) fixed on the inside of said void, and ball runner means (120, 121) mounted on each of said sliding doors or sashes, and in which at least one ball (121) for each sliding door or sash is engaged so as to be able to roll freely in one track (117.2, 118.2) of said track means, and in that said track provides a forced path for said at least one ball mounted on each of said sliding doors or sashes along a section of track (117.21, 118.21) and at least two track branches (117.22, 117.23, 118.22, 118.23) which diverge from said section and are in mirror symmetry about a plane orthogonal to this track, in such a way that:

- when at least one ball mounted on a first sliding door or sash is engaged at the end of its travel in at least one branch of the track on one side of said plane orthogonal to this track, while at least one ball mounted on the other door or sash is engaged at the end of its travel in at least one branch of the track on the other side of said orthogonal plane, the doors or sashes are side by side, thus closing the void;
- on the other hand, when at least one ball mounted on a first sliding door or sash is engaged at the end of its travel in at least one branch of the track on one side of said orthogonal plane, while at least one ball mounted on the other door or sash is engaged in said section of the track, the latter door or sash can be slid into the open position of said void, by for example superimposing it over the first door or sash.

11. Sliding system according to Claim 10, characterized in that it comprises at least one rotation member (123) mounted on each of said sliding doors or sashes (111, 112) and located closer to said orthogonal plane than said ball runner means (120, 121) mounted on the same door or sash, and also comprises barrier means (124, 125, 126) to act on said at least one rotating member (123) as a means of facilitating and ensuring the correct movement of this door or sash on said at least one ball between said track section (117.21, 118.21) and said track branches (117.22, 118.22, 117.23, 118.23) of said track.

12. Sliding system according to Claim 11, characterized in that said barrier means (124, 125, 126) possess barrier arms (126.21, 126.22) positioned at different heights, each barrier arm being situated at a height corresponding to the height at which a respective rotating member (123) mounted on an associated door or sash (111, 112) travels, in such a way that each rotating member never contacts the arm of the barrier contacted by another rotating member.

13. Sliding system according to Claim 12, characterized in that said barrier arms (126.21, 126.22) of said barrier means (124, 125, 126) are each slightly bent at the end towards their respective rotating member (123) so as to lead the rotating member in to the barrier.

14. Sliding system according to Claim 13, characterized in that said lead-in end on each barrier arm (126.21, 126.22) of said barrier means (124, 125, 126) is positioned on the path followed by a respective rotating member (123) with its door or sash (111, 112), when said at least one ball (121) of the ball runner means (120, 121) mounted on this door or sash rolls along said track branches (117.22, 118.22, 117.23, 118.23) of said track (117.2, 118.2).

15. Sliding system according to any of the previous claims, characterized in that said track means (17, 18; 42, 43; 117, 118) comprise at least one channel-like track (17.2, 18.2; 42.1, 43.1; 117.2, 118.2) formed in a plate (17.1, 18.1; 117.1, 118.1) by, for example, milling.

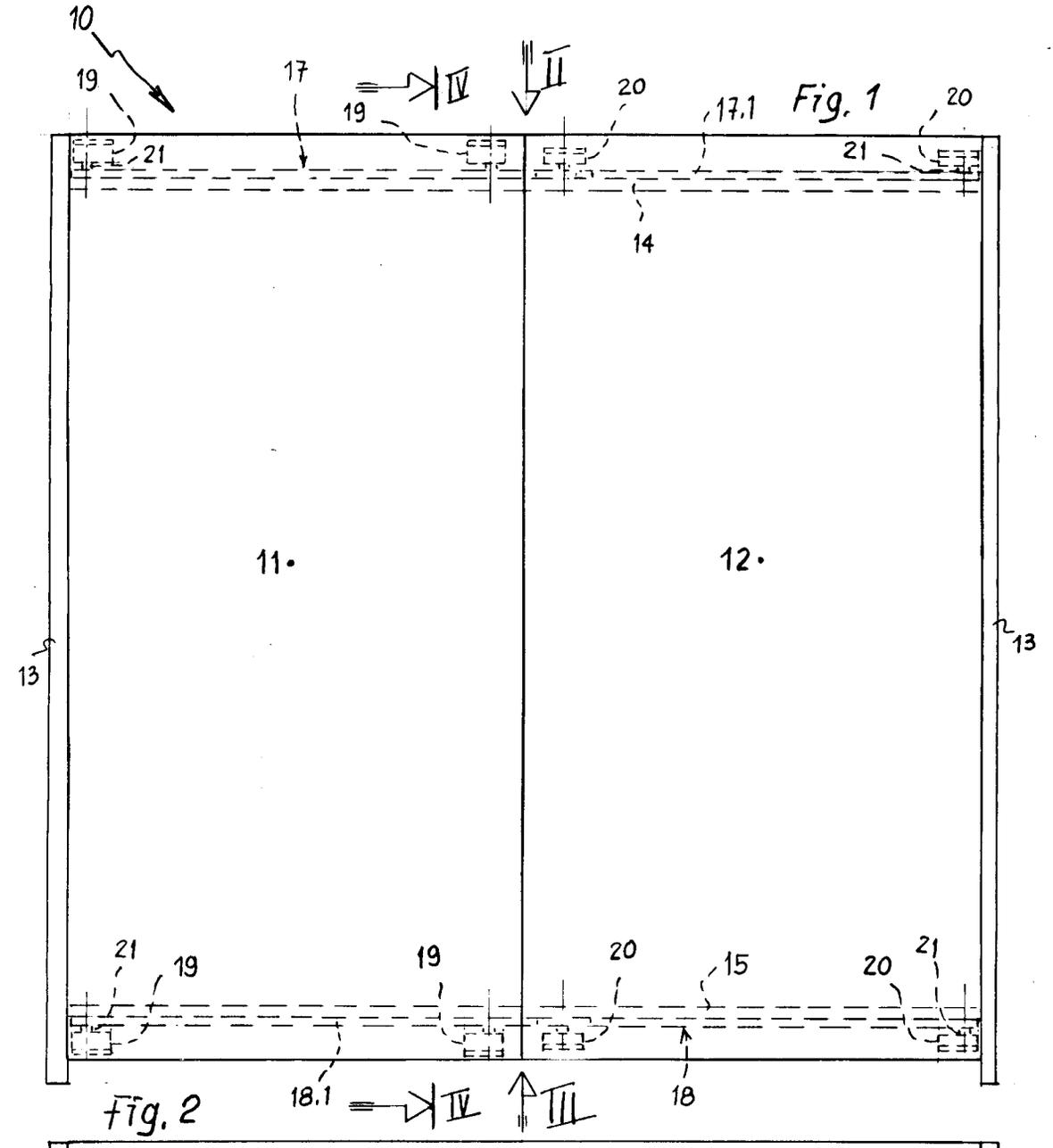
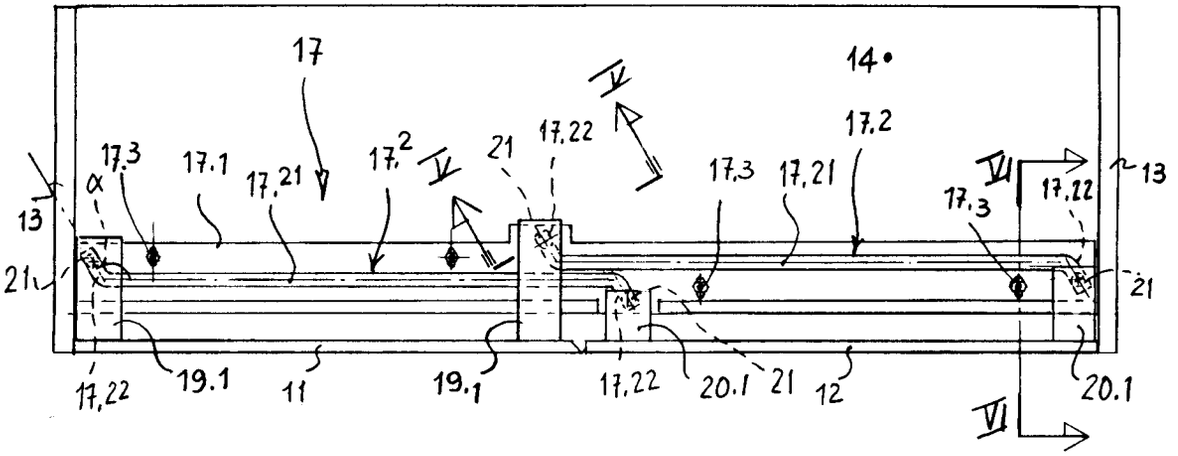

10
19
17
IV
19
II
20
17.1
21
20
21
14
11
12
13
13
21
19
19
20
15
20
21
18.1
IV
III
18

Fig. 1

Fig. 2


17
14
IV
17.3
17.1
17.21
17.2
IV
21
17.22
17.2
17.3
17.21
VI
17.3
17.22
13
13
α
21
21
17.22
19.1
11
19.1
17.22
20.1
21
12
20.1
VI

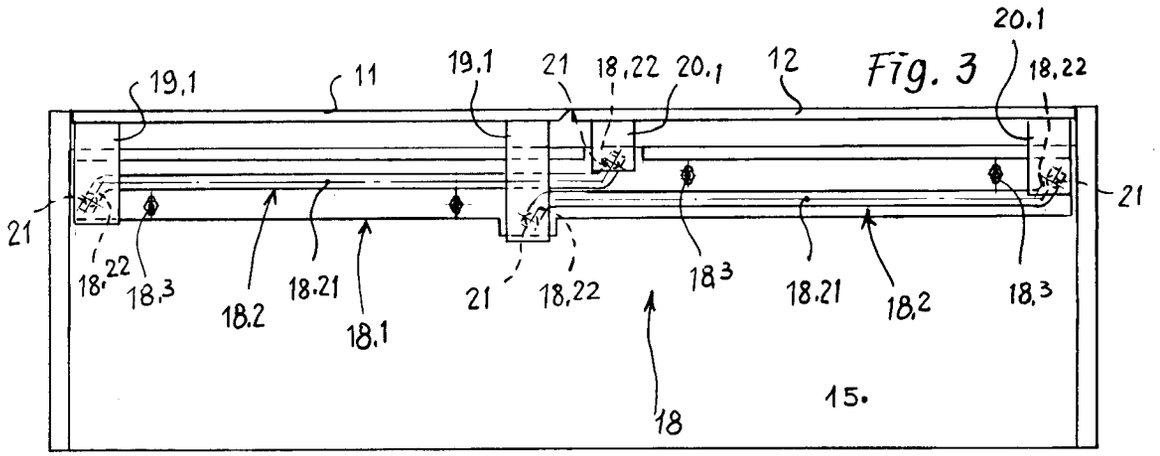


Fig. 3

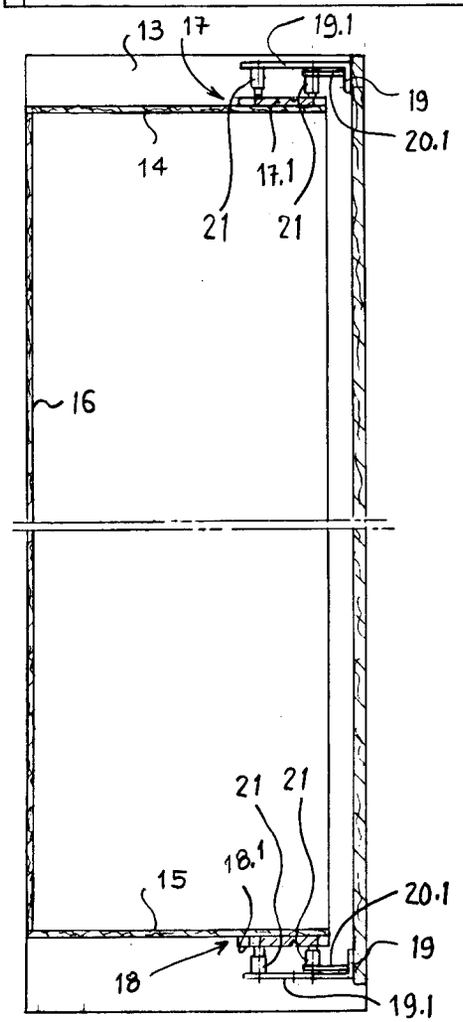


Fig. 4

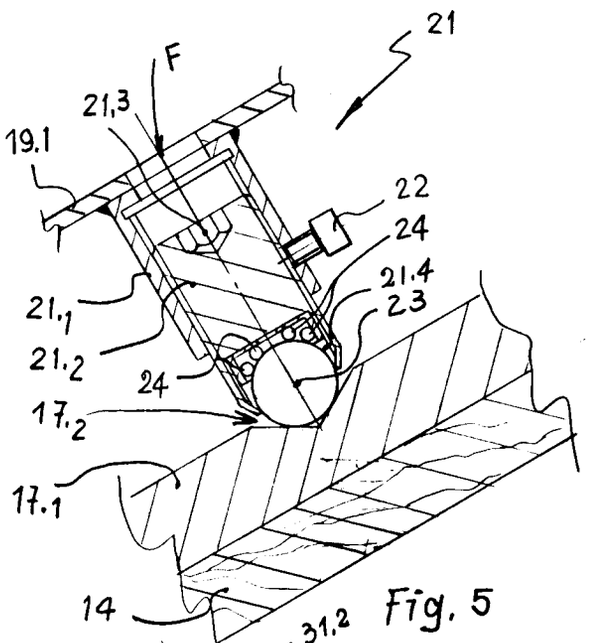


Fig. 5

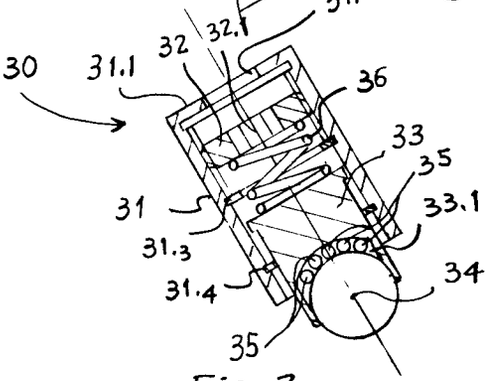


Fig. 7

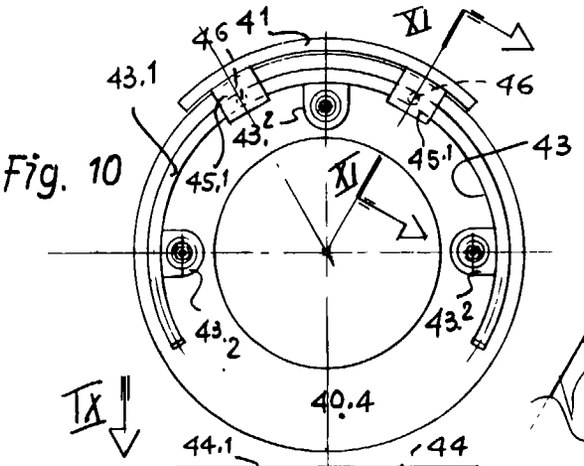


Fig. 10

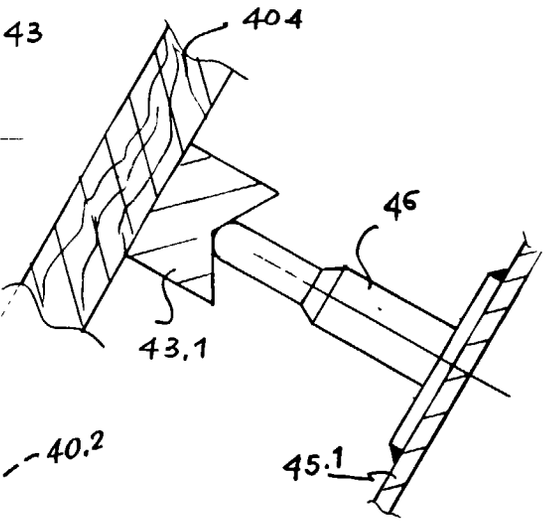


Fig. 11

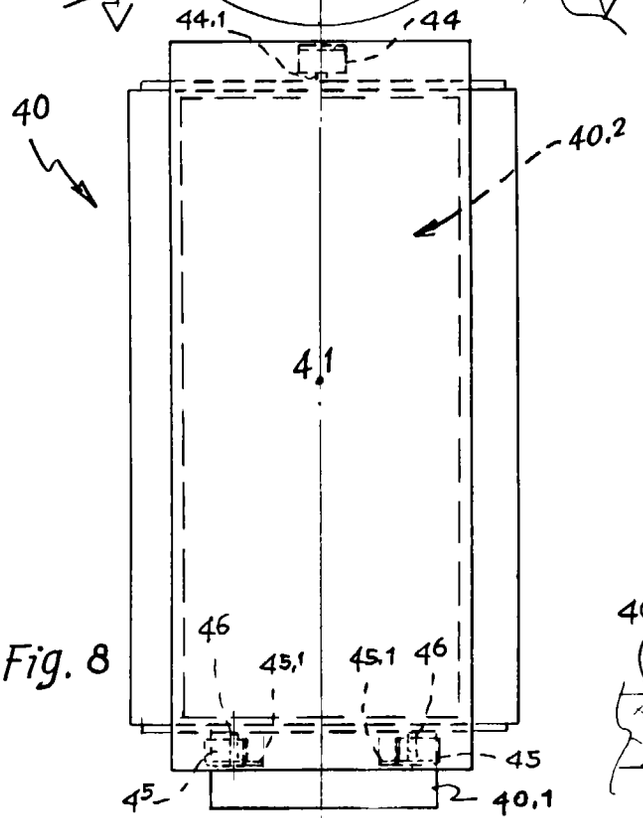


Fig. 8

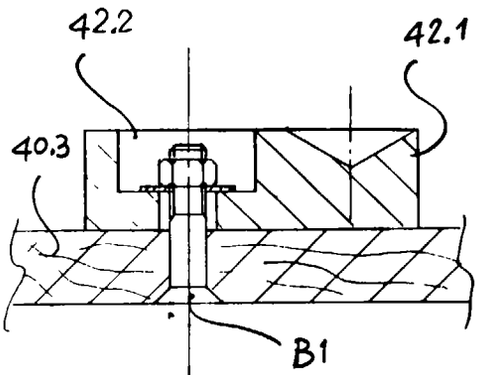


Fig. 12

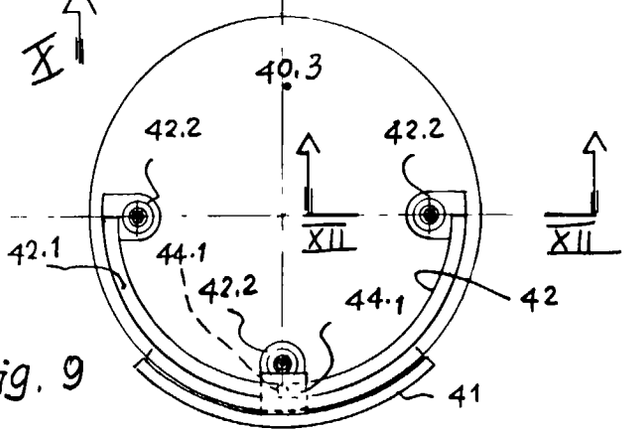


Fig. 9

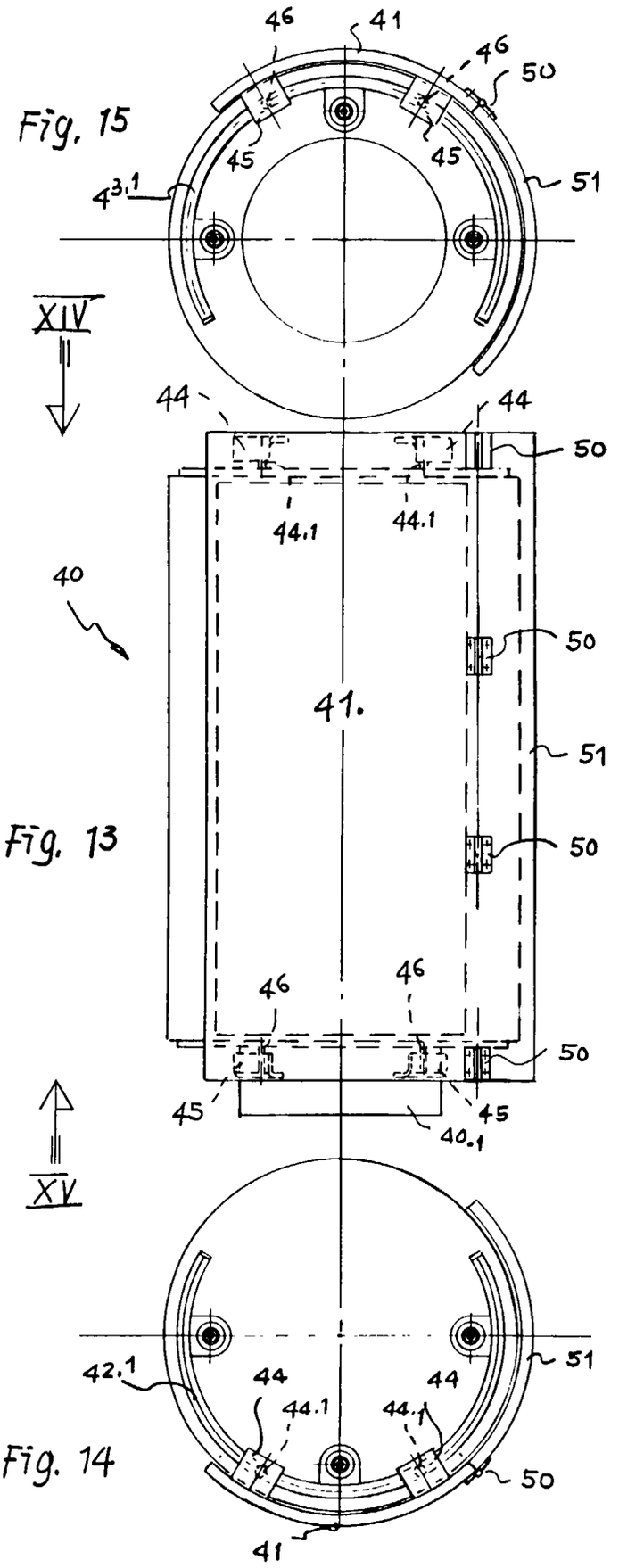


Fig. 15

Fig. 13

Fig. 14

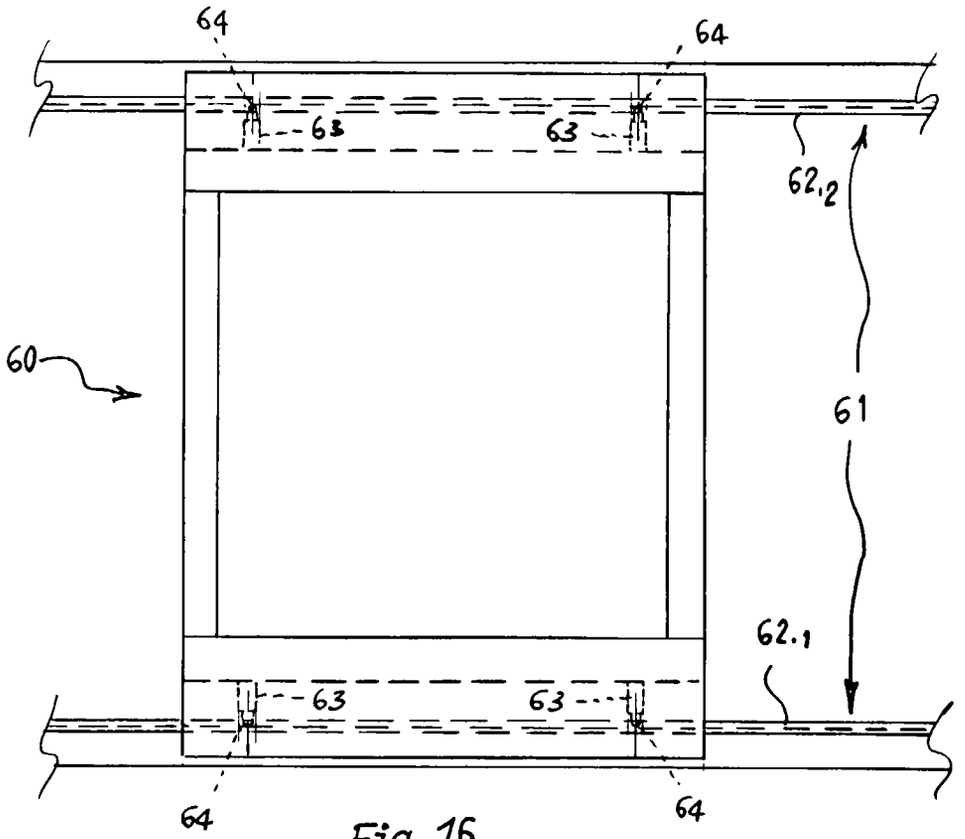


Fig. 16

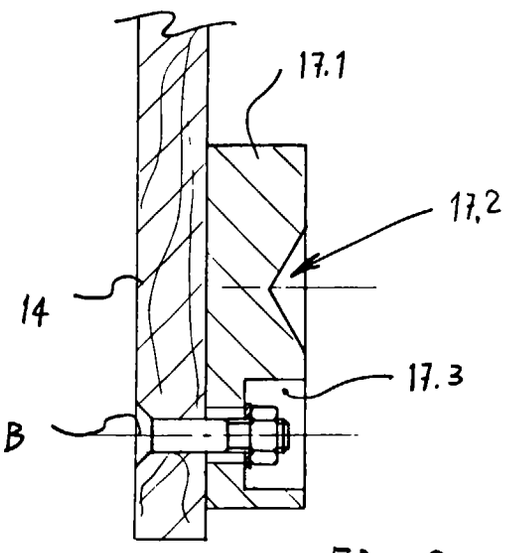
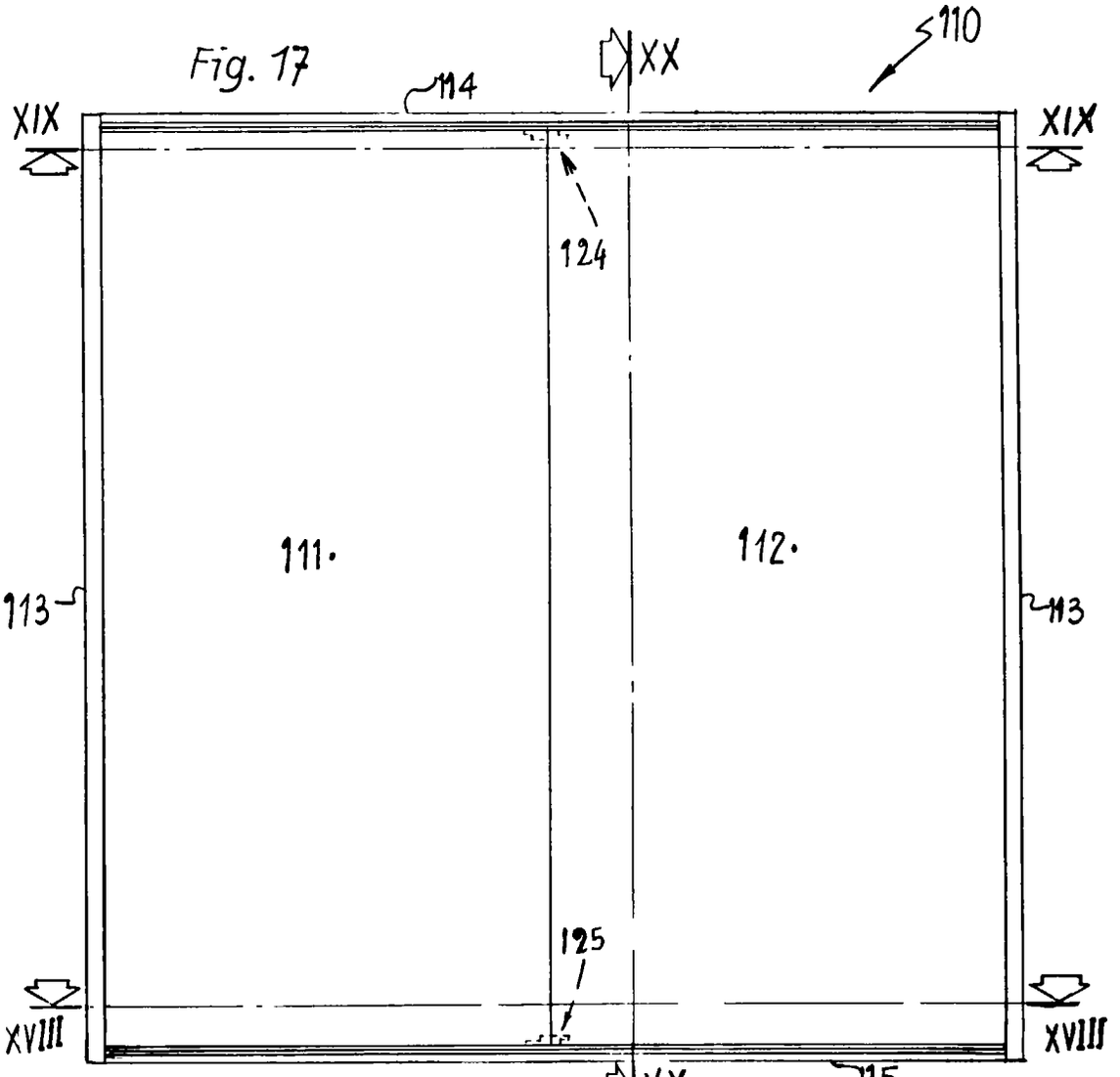


Fig. 6

Fig. 17


110
114
XX
XIX
XIX
124
111
112
113
113
125
XVIII
XVIII
XX
115
116

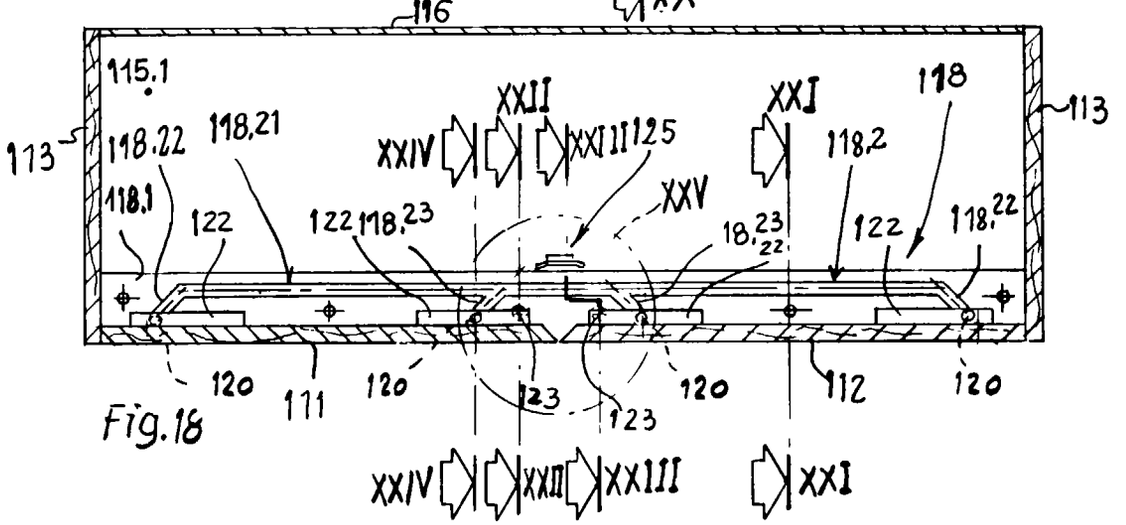

115.1
113
113
118.22
118.21
118.1
122
122
118.23
XXII
XXIV
XXIII
125
XXV
XXI
118.2
118
18,23,22
122
118.22
120
111
120
123
123
120
112
120
XXIV
XXII
XXIII
XXI

Fig. 18

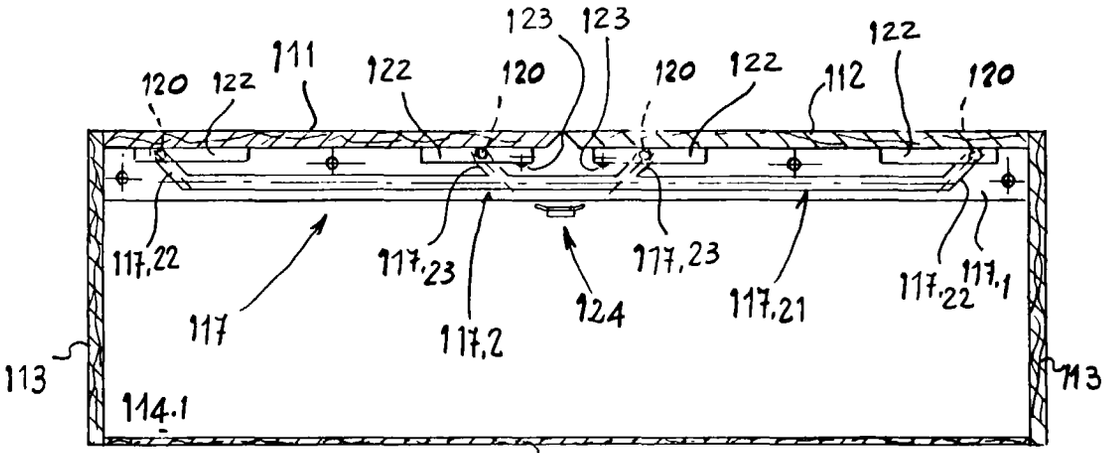


Fig. 19

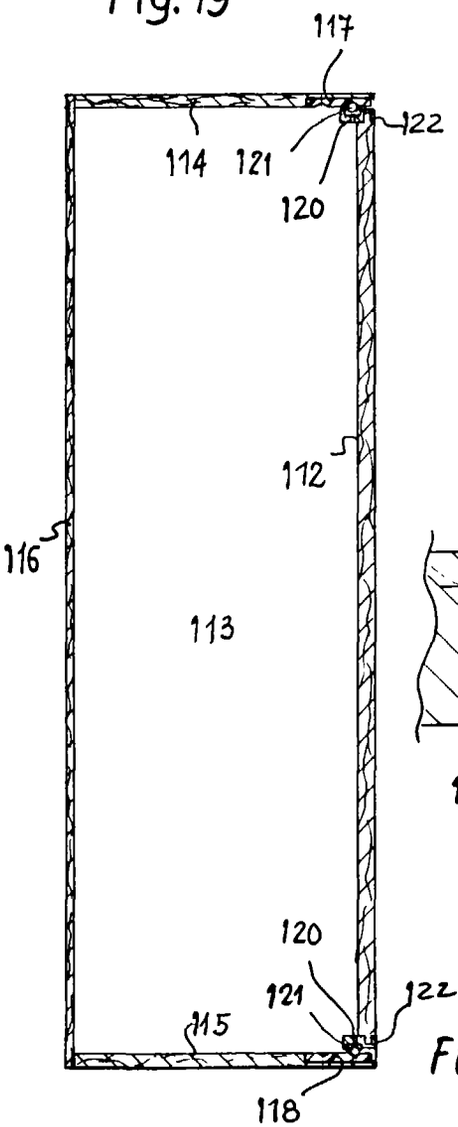


Fig. 20

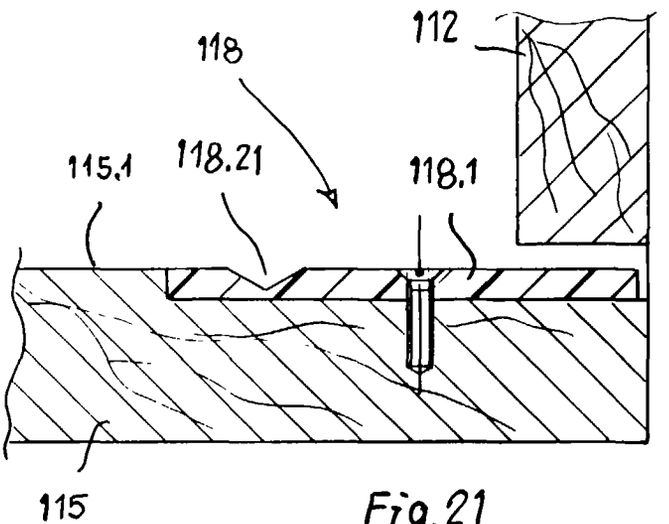


Fig. 21

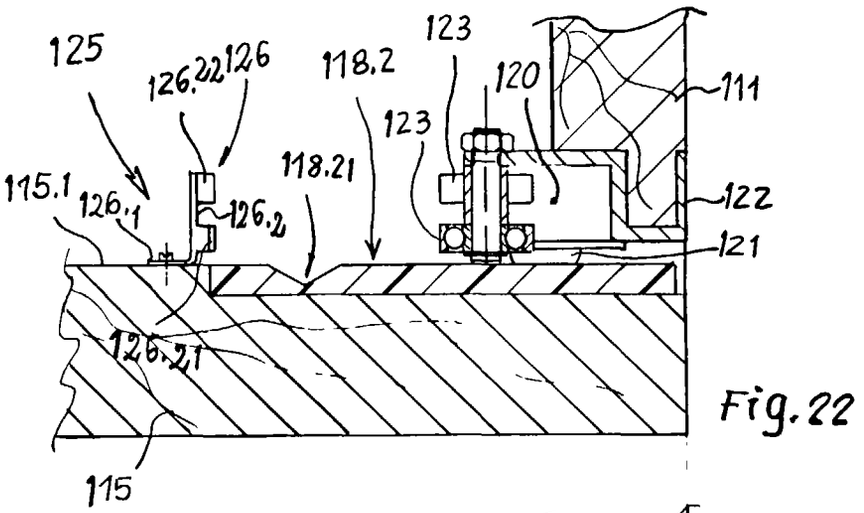


Fig. 22

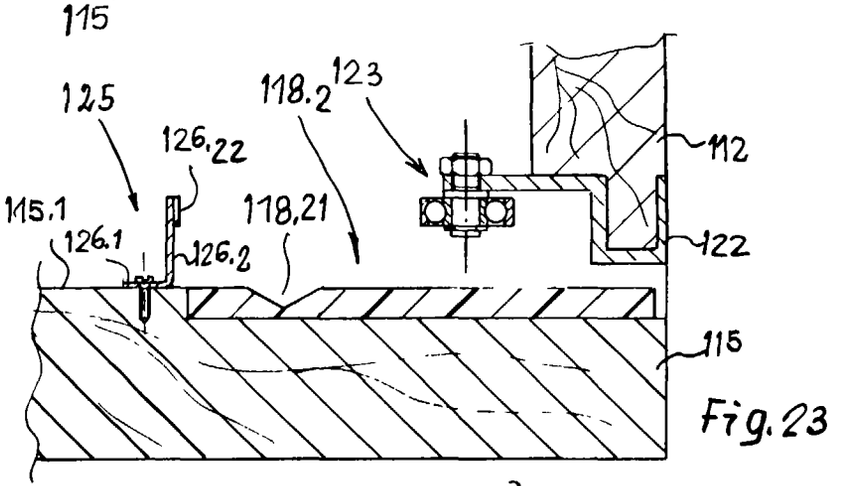


Fig. 23

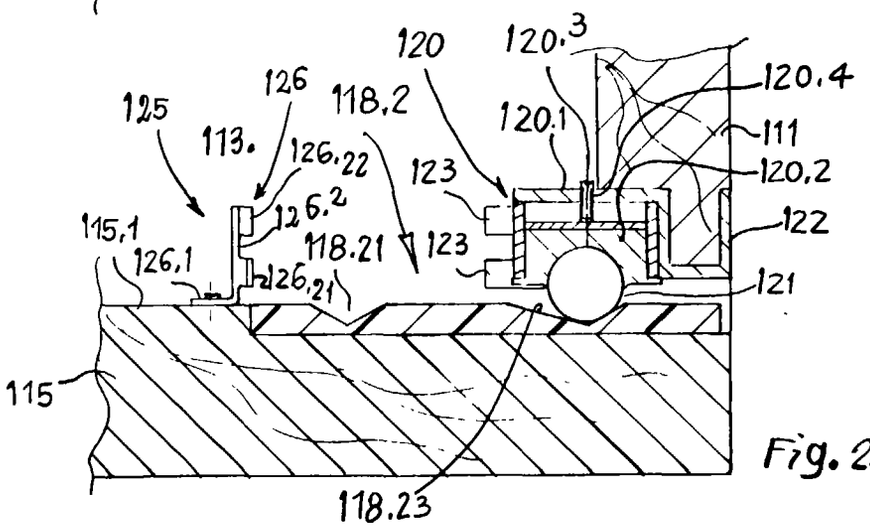


Fig. 24

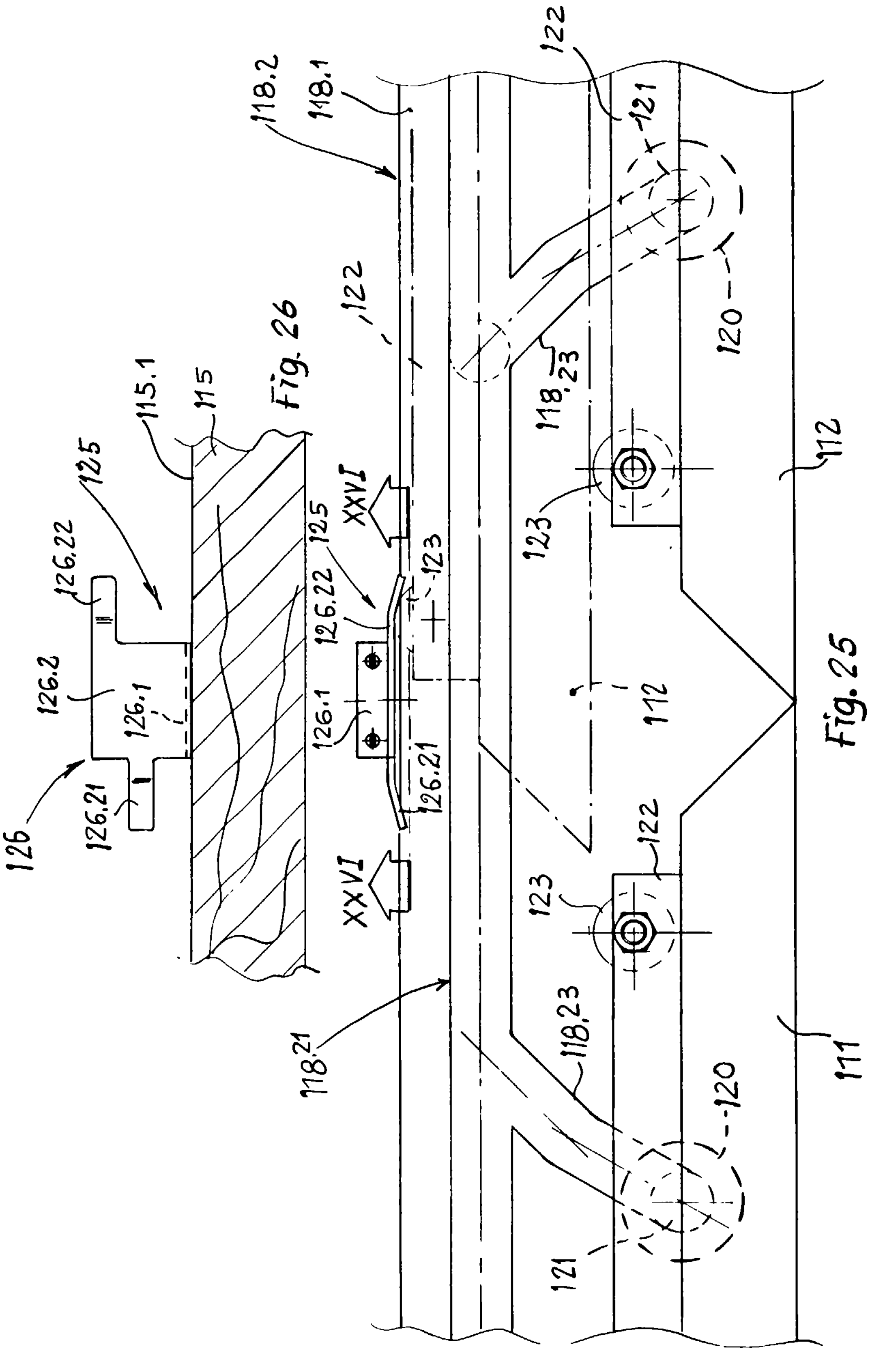
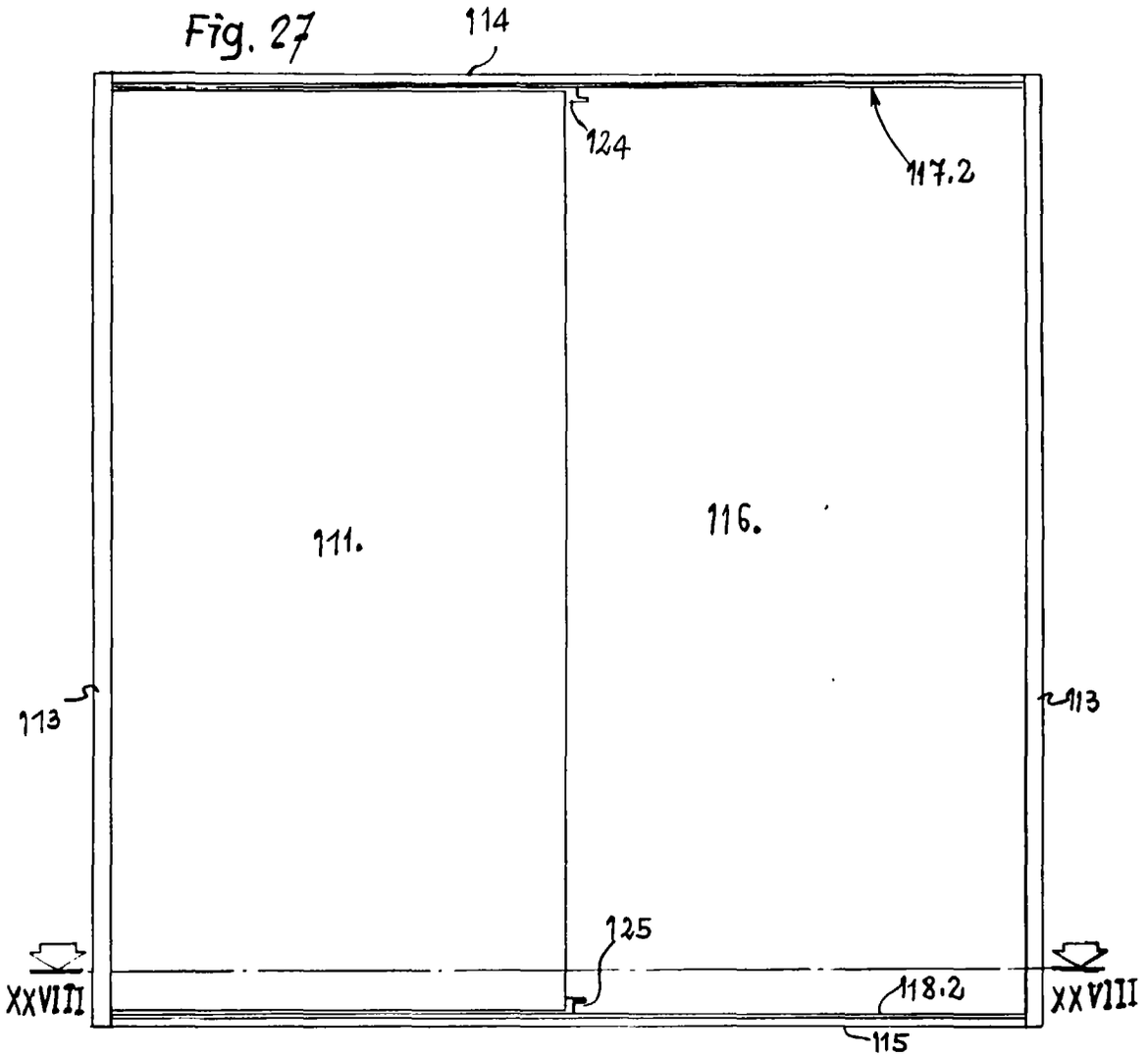

118.2
118.1
122
121
120
118.23
112
123
XXVI
125
126.22
126.1
126.21
115.1
115
126
126.2
118.21
111

Fig. 26

Fig. 25

Fig. 27


114
124
117.2
111.
116.
113
113
125
XXVIII
XXVIII
118.2
115

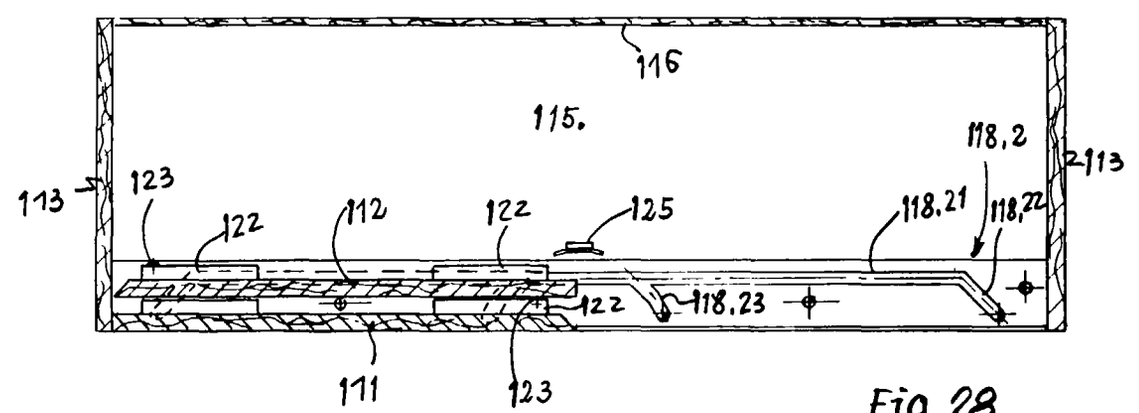

116
115.
118.2
113
113
123
122
112
122
125
118.21
118.22
122
118.23
111
123

Fig. 28

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 12 0047

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	EP 0 005 314 A (SANDERSON) * page 5 - page 13; figures *	1,2,4,5, 7,8 11	E05D15/10
X	GB 500 981 A (JUDGE ET AL) * page 5, line 26 - page 7, line 4; figures *	1-3,7,8, 10,15	
X	GB 589 368 A (MASON ET AL) * page 3, line 21 - line 118; figures *	1-3,7,8, 10,15	
Y	US 3 071 825 A (FERRIS) * column 5, line 40 - line 54; figures 5-7 *	11	
A	EP 0 340 517 A (MOLTENI) * column 5, line 54 - column 6, line 4; figures *	11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) E05D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 March 1997	Van Kessel, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)