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(54) Counterweight guiding arrangement for an elevator

(57) A counterweight guiding arrangement for an elevator is disclosed. It comprises at least one guide rail (10), at least one roller guide (20) configured to move along the guide rail, the guide rail comprising two lateral portions (11) defining a guide groove (12) therebetween. The roller guide comprises a guide frame (21) and at least two roller wheels (22) attached to the guide frame. Each of the roller wheels has a plane of rotation (23). The counterweight guiding arrangement is characterized in that each of the roller wheels is configured to move along a guide groove-facing surface (13) of one of said lateral portions, so that each said guide groove-facing surface has at least one roller wheel configured to move thereon. It is further characterized in that there are at least two planes of rotation of the roller wheels, the planes of rotation being at an angle to each other, and that the projections of the roller wheels on a plane perpendicular to the direction of the roller guide movement overlap at least partially.

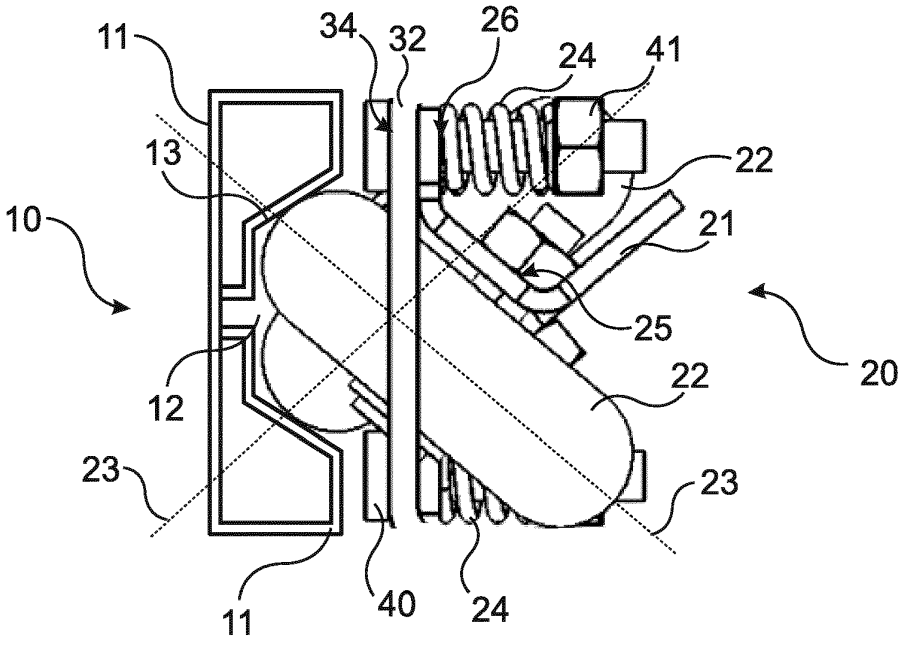

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to an elevator counterweight guiding arrangement and the use thereof. The disclosure further relates to a roller guide, a counterweight and an elevator.

BACKGROUND ART

[0002] In a traction elevator, a counterweight is used to balance the load of an elevator car, thus reducing power required for the vertical movement of the elevator car. The elevator car and the counterweight are attached to the opposing ends of a hoisting cable and they move reciprocally in the elevator shaft. The movement of the counterweight is usually directed by at least one guide rail, typically by two that are located on two opposing sides of the counterweight.

[0003] The counterweight is formed of a metal frame, often including two vertical side beams and two horizontal cross beams. The weight of the counterweight is adjusted with fillers that are packed within the frame. The counterweight further has an attachment mechanism for the hoisting cable and guide shoes mediating the contact between the counterweight and the guide rails.

[0004] To keep the energy consumption at a minimum and to avoid noise and vibration during elevator operation, the counterweight should move as smoothly as possible along the guide rails. The counterweight is placed in the elevator shaft and often space for it, both in vertical and horizontal directions, is limited. At the same time, the counterweight needs to have a sufficient weight in order to perform its balancing function effectively.

[0005] Currently, the counterweight guide shoes are often roller guides equipped with three rollers, each facing the blade of a T-profiled guide rail from one direction. This type of a guide shoe has to be installed above the upper counterweight frame cross beam and below the lower counterweight frame cross beam, thus reducing the effective height usable for fillers. As an alternative, patent document CN 101423163 discloses an elevator running guide apparatus comprising guide rail components and guide shoe components. The guide rail components comprise a guide rail provided with two guide faces forming a guide groove. The width of the guide groove decreases with the increase of groove depth. The guide shoe components comprise a roller running inside the guide groove and a work face matching with the guide faces is respectively formed on two sides of the outer edge of the roller. This type of a roller guide is prone to produce vibration and uneven load on the components as the roller has more than one contact surface with the guide rail.

SUMMARY

[0006] An object of the present invention is to provide a counterweight guiding arrangement that functions smoothly and might enhance space usage of the counterweight arrangement.

[0007] The counterweight guiding arrangement, the roller guide and the counterweight according to the present disclosure and their use are in particular, but not only, intended for elevators, especially for passenger or cargo elevators of buildings.

[0008] The counterweight guiding arrangement according to the present disclosure is characterized by what is presented in claim 1.

[0009] The roller guide according to the present disclosure is characterized by what is presented in claim 9.

[0010] The counterweight according to the present disclosure is characterized by what is presented in claim 10.

[0011] The elevator according to the present disclosure is characterized by what is presented in claim 14.

[0012] The use of the counterweight guiding arrangement according to the present disclosure is characterized by what is presented in claim 15.

[0013] The counterweight guiding arrangement according to the present disclosure and its use can offer at least one of the following advantages over prior art.

[0014] Unwanted horizontal movement of the counterweight can be effectively reduced while keeping the number of roller guide components modest.

[0015] The horizontal space taken by the roller guide can be reduced. The crossed orientation of the roller wheels can save space within the counterweight arrangement. Further, the roller guide can be mounted partially within the counterweight frame, possibly leading to further space saving and allowing the increase in the effective height of the counterweight.

[0016] The volume available for fillers may be increased allowing the use of more varied filler materials.

BRIEF DESCRIPTION OF DRAWINGS

[0017] The accompanying drawings, which are included to provide a further understanding of the disclosure and constitute a part of this specification, illustrate embodiments of the invention and together with the description help to explain its principles. The disclosure is not limited to the specific embodiments illustrated in the drawings.

[0018] In the drawings:

Fig. 1 presents a counterweight guiding arrangement according to the present disclosure seen in the direction of the roller guide movement.

Figs. 2A and 2B present a roller guide according to the present disclosure seen from two different perspectives.

Fig. 3 depicts a counterweight having roller guides according to the present disclosure mounted at its

side beams.

Fig. 4 depicts a detail of the counterweight presented in Fig. 3.

Fig. 5 depicts a counterweight and a counterweight guiding arrangement according to the present disclosure viewed in the direction of the roller guide movement.

Fig. 6 presents a detail of the counterweight and the counterweight guiding arrangement of Fig. 5.

Fig. 7, panels a)- i), is a schematic illustration of some possible guide rail cross-sectional profiles.

Fig. 8, panels a) - d), is a schematic illustration of some possible roller wheel profiles.

DETAILED DESCRIPTION

[0019] In one aspect, a counterweight guiding arrangement for an elevator is disclosed. It comprises at least one guide rail and at least one roller guide configured to move along the guide rail. The guide rail comprises two lateral portions defining a guide groove therebetween, the guide groove extending in the direction of the roller guide movement. The roller guide comprises a guide frame and at least two roller wheels attached to the guide frame, each of the roller wheels having a plane of rotation. The counterweight guiding arrangement is characterized in that each of the roller wheels is configured to move along a guide groove-facing surface of one of said lateral portions, so that each said guide groove-facing surface has at least one roller wheel configured to move thereon. The counterweight guiding arrangement is further characterized in that the projections of the roller wheels on a plane perpendicular to the direction of the roller guide movement overlap at least partially and that there are at least two planes of rotation of the roller wheels, the planes of rotation being at an angle to each other.

[0020] A counterweight is used in a traction elevator to reduce the amount of power required for moving the elevator car vertically in the elevator shaft. The movement of the counterweight is guided by at least one guide rail along which the counterweight moves.

[0021] A guide rail typically extends the whole length of the elevator movement. The guide rail is mounted to a wall or walls of the elevator shaft. The guide rail according to the present disclosure has two lateral portions defining a guide groove therebetween. Each lateral portion has at least one surface. A surface facing the guide groove is a guide groove-facing surface. The guide groove is substantially as long as the guide rail, allowing the movement of the roller guide in the direction of the guide groove. By the direction of the roller guide movement is herein meant the direction in which the roller guide is configured to move, i.e. the direction in which the guide groove extends. The determination of this direction does not require the movement of the roller guide.

[0022] The lateral portions defining a guide groove cause the cross section of a guide rail according to the present disclosure to have a valley between the two lateral portions. By a guide groove-facing surface is herein meant the whole length of the cross section of the guide groove side. The guide groove-facing surface can have various forms. It can be straight, curved or it can have one or more bends with straight or curved sections in between. The depth of the guide groove (i.e. the distance between the lowest point of the guide groove an the top of the side portion) can vary. Also the width of the guide groove can vary, as well as the ratio between the depth and the width of the guide groove.

[0023] The preferred form of the guide groove cross section is symmetrical. This means that both guide groove-facing surfaces of the guide rail lateral portions have the same shape, but mirrored relative to each other. Also other parts of the lateral portions are usually symmetrical in cross section, but it is not necessary, and embodiments having asymmetrical lateral portions can be envisaged.

[0024] In addition to the guide groove-facing surfaces of the guide rail lateral portions, which form the sides of the groove, the groove can have a bottom. The width of the bottom can vary and depends on the overall shape of the guide rail cross section. The bottom of the guide groove can be the structure connecting the two lateral portions. The guide rail can have other structures connecting the lateral portions in addition to or instead of the bottom.

[0025] In one embodiment, each of the guide groove-facing surfaces of the lateral portions has a straight cross section. In this embodiment, the guide groove-facing surface is a straight slope. The sloping surfaces can meet in the middle of the guide groove or there can be a flat or an arched bottom in the guide groove. In one embodiment, when the guide groove-facing surfaces of the lateral portions in the guide rails have a straight cross section, there is an angle between the guide groove-facing surfaces of the guide rail and the angle is 80° - 110°, preferably 85°-100°. For example, the angle between the guide groove-facing surfaces can be 90°. It is possible for one guide groove-facing surface to have a cross section, where there are two or more straight sections being at an angle to each other and a bend between each straight section. In this case, the angle between the surfaces is determined by those surfaces on which the roller wheels are configured to move.

[0026] In addition to the two lateral portions and a guide groove, additional elements to the guide rail, such as means for wall mounting or guide rail construction, are possible. Their design is within the knowledge of the skilled person. Any material known in the art can be used for constructing the guide rail according to the present disclosure. Examples of materials include metals, such as steel or aluminum. Method of manufacturing a guide rail according to the present disclosure is within the knowledge of the skilled person.

[0027] The smooth movement of the counterweight is preferable in order to reduce the noise and vibration produced during elevator operation. Therefore, the counter-

weight movement along the at least one guide rail is conveyed by at least one guide shoe that is mounted between the counterweight and the guide rail and which is in contact with both. The guide shoe can be a separable component to the counterweight. It can alternatively be an integral part of the counterweight. In many situations, for one counterweight, there are two guide shoes running along each guide rail. It is possible to have three or more guide shoes running along each guide rail for one counterweight.

[0028] The guide shoe can be a roller guide. A roller guide is a guide shoe utilizing roller wheels that roll along the guide rail. The roller wheels in a roller guide can be replaceable. This is because they might wear during usage leading to unevenness in counterweight movement. By a counterweight guiding arrangement is herein meant a system comprising at least one guide rail and at least one guide shoe, the guide shoe being a roller guide. Together they form a functional counterweight guiding entity when their positions and structure are matched. There might be more than one counterweight guiding arrangement for one counterweight. One counterweight guiding arrangement can comprise one guide rail and two or three roller guides.

[0029] The roller guide according to the present disclosure comprises a guide frame and at least two roller wheels attached to the guide frame. Typically, the roller wheels run at least partly in the guide groove. The guide frame provides a scaffold for the roller wheels. It is typically made of metal, such as steel, iron, aluminum or a combination thereof. It can alternatively made of composite material, such as fiber-reinforced plastic. The guide frame can be made, for example, of pre-formed profile that is cut in the correct shape. Alternatively, the guide frame can be made by casting a suitable material. A suitable material is any material that can be introduced in a mold and is curable thereafter. The guide frame can be constructed from one piece. Alternatively, it can be constructed from more than one piece attached to each other to form the guide frame. The guide frame comprises the fastening means for attaching the roller wheels to the guide frame. It is structured to positions the roller wheels in an appropriate orientation relative to the guide rail. The fastening means can be any type known in the art as long as it is sufficiently strong and allows easy rotation of the roller wheel. The fastening means can be a hole configured to receive a bolt or a screw for attaching the roller wheel to the guide frame.

[0030] The distance between the roller wheels in the direction of the roller guide movement can vary. The longer the guide frame, the further apart the roller wheels can be located from each other. A suitable distance can be selected for each application. An example of a suitable distance, measured as the distance between the axles of two roller wheels is approximately 60-135 mm, depending on the diameter of the roller wheels.

[0031] The guide frame further comprises installation means for securing it to the counterweight. The counterweight, for its part, comprises suitable installation point or installation points for receiving the roller guide or roller guides. The installation means and the respective installation points can, in a simple embodiment, mean holes through which bolts or screws are fittable for attaching the roller guide at the counterweight. In many situations, the counterweight comprises a frame with two side beams. In such a situation, the roller guide according to the present disclosure is typically installed at a side beam. The guide frame can be installed on the side beam or in it. The installation can be permanent, if the roller guide is, for example, welded to the counterweight. The roller guide can be installed non-permanently, through detachable installation means, such as screws or bolts, as is known in the art. In many applications, there are four roller guides attached to the counterweight, two on each side. The two roller guides positioned on one side of the counterweight are often located as far as possible from each other to provide best possible support for the counterweight. It is possible to have only one roller guide on each side of the counterweight. It is also possible to have more than two roller guides on one side of the counterweight, for example three or four.

[0032] In one embodiment, the guide frame comprises at least one elastic element for springing the roller guide. The movement of the roller guide along the guide rail might be smoother if there is at least one elastic element in the roller guide. By springing is herein meant the dampening of the jumps and vibrations occurring during roller guide movement. The elastic element (s) can be used in in the installation means. Alternatively, the elastic element(s) can be used in the fastening means between the roller wheel and the guide frame. It is possible that there are more than one elastic element either in the installation means or in fastening means, or both. It is also possible that some other part of the guide frame comprises at least one elastic element. In one embodiment, when there is at least one elastic element in the roller guide, the at least one elastic element is an elastic spacer or a spring, such as a helical spring or a leaf spring, or an integrated spring achieved through local elasticity of the roller guide. Often, one or more helical springs are used for springing wheels running on a surface. For this purpose, also leaf springs can be used. If the springing is achieved through local elasticity of the roller guide, the elasticity can be located in the guide frame. This can be effected by, for example, constructing the guide frame from more than one piece and using different materials in them. In some situations, it is possible to achieve sufficient springing by selecting elastic material to be used in the roller wheels.

[0033] The roller guide further comprises at least two roller wheels. Each roller wheel as an axle and suitable bearings associated with it as is known in the art. The roller wheel is attachable to the guide frame through fastening means in the guide frame. The diameter of the roller wheels can vary according to the specifics of the application. In a typical example, the diameter is 50 mm. The diameter can vary between applications at an ap-

proximate range from 45 mm to 100 mm. The diameter can be, for example, 70 mm. The diameter can be 55 mm. Also the thickness of the roller wheels, i.e. the size of the roller wheel measured in the direction of the axle can vary. Typically it measures at least 20 mm. In most cases, the thickness is measured at the thickest point of the roller wheel. The thickness can be, for example, 30 mm or 45 mm.

[0034] Many different profiles for the roller wheel are possible. By a roller wheel profile is herein meant the overall shape of the area of the roller wheel that mediates the contact of the roller guide to the guide rail. The profile can be flat or it can be curved. It can also be flat with a bend, for example if the guide groove-facing surface that it is configured to move on has a complementary bend. The roller wheel can be asymmetrical so that its diameter on one side is larger than on the other. Such an asymmetrical shape leads to a sloped profile when viewed in the direction of the roller guide movement. The profile in itself can be flat, curved or have a bend. The roller wheels can be made of one or several materials. Many suitable materials are known in the art and they include metals optionally combined with plastic, rubber and/or composite materials.

[0035] In the counterweight guiding arrangement according to the present disclosure, each roller wheel is configured to move along a guide groove-facing surface of a lateral portion. In some cases, each roller wheel might touch also other parts of the guide groove. For example, the roller wheel could be in contact with another guide groove-facing surface or with the bottom of the guide rail. The roller wheel can be shaped to adjust the size of roller wheel-guide rail contact area. In different applications, the optimal size of the contact area might differ. If there is a bend in the guide groove-facing surface, the roller wheel can have a complementary bend so that the roller wheel touches the guide rail on both sides of the bend.

[0036] In one embodiment, each roller wheel is in contact only with one guide groove-facing surface of a lateral portion. In such an embodiment, each roller wheel runs along a single surface of a guide rail. This configuration is likely to reduce the possibility of vibration that might be caused, if the friction between the roller wheel and one of the surfaces is different of that between the roller wheel and another surface. Further, it might be possible that the alignment of the roller wheel axle and the direction of the roller wheel rotation is easier in the case of a single contact surface.

[0037] In the counterweight guiding arrangement according to the present disclosure, each guide groove-facing surface has at least one roller wheel configured to move thereon. Thus, if there are two roller wheels in a roller guide, each of them moves along a different guide groove-facing surface. If there are three roller wheels in a roller guide, one of them touches one guide groove-facing surfaces while both the remaining wheels touch another surface. If there are four roller wheels in a roller guide, most typical embodiment would be two roller wheels touching one guide groove-facing surface and the other two touching another surface. Nothwithstanding embodiments where each roller wheel touches only one surface of the guide rail, the roller wheels can also share some surfaces that they move along. For example each roller wheel can touch one guide groove-facing surface and additionally the bottom of the guide groove.

[0038] In the counterweight guiding arrangement according to the present disclosure, there are at least two planes of rotation of the roller wheels. By a plane of rotation is herein meant the imaginary plane through which the roller wheels rotation axis runs in a perpendicular direction. Thus, there are at least two horizontal directions (i.e. directions perpendicular to the roller guide movement) from which the roller guide is supported. Each roller guide can thus support the counterweight from at least two directions. In most cases, the supporting force is distributed in to a plurality of directions stabilizing the counterweight movement in many directions. Such a configuration can reduce unwanted horizontal movement of the counterweight.

[0039] In one embodiment, the angle between the at least two planes of rotation of the roller wheels is 40° - 110°, preferably 60° -90°. The angle can be, for example 50°. Such narrower angles might be suited especially well in embodiments comprising more than two roller wheels. For some embodiments, an angle of, for example, 95° might be optimal. The distribution of the supporting force in different directions perpendicular to the roller guide movement depends partly on the angle between the planes of rotation. Also the shape and angle of the guide groove-facing surfaces of the lateral portions affects the distribution of the supporting force. The optimal combination depends on the application and its determination is belongs to the competence of the skilled person.

[0040] The angle between the at least two planes of rotation is independent of the angle between the guide groove-facing surfaces of the lateral portions. Only in embodiments there the angle between the plane of rotation of the roller wheel and the guide groove-facing surface of the lateral portion is fixed, these two angles are coupled. In one embodiment, the plane of rotation of at least one of the roller wheels is substantially at a right angle relative to the guide rail-facing surface of the lateral portion that it is configured to move on. If all the roller wheels are substantially at a right angle to the guide groove-facing surface they move on, the angle between these surfaces determines the angle between the planes of rotation. If the profile of the roller wheel is flat, the angle between the guide groove-facing surface and the roller wheel is substantially 90°

[0041] The roller wheels in the counterweight guiding arrangement according to the present disclosure are situated in a cross-like fashion. This means, that the projections of the roller wheels on a plane perpendicular to the direction of the roller guide movement overlap at least partly. In other words, when viewed in the direction along

the guide rail, the further roller wheel is partially behind the roller wheel closer to the viewer. The magnitude of the overlap can vary between applications. It depends, for example, on the shape and angle of the roller wheels to each other (i.e. the angle between the planes of rotation). The roller wheels can cross at their middle (i.e. at the point where their axes are). Alternatively, they can cross closer to the surfaces along which they move or further away from them.

[0042] If a counterweight is guided by two guide rails, the counterweight typically runs between them. Then roller guides are arranged on two opposing sides of the counterweight. Their placement can be optimized to provide as good support for the counterweight as possible. Usually this mean that there are at least two roller guides on each side of the counterweight and they are situated as far from each other as other counterweight components allow. The number and location of the roller guides depends on the weight an construction details of the counterweight and can be determined by the skilled person.

[0043] The use of two guide rails has the advantage that the horizontal (i.e. perpendicular to the direction of the counterweight movement) supporting forces for the counterweight come from opposing directions. When the counterweight guiding arrangement according to the present disclosure is used, the supporting forces from each roller guide are distributed in several directions. This is due to the combination of the differing planes of rotation of the roller wheels and/or the orientation of the guide groove-facing surfaces in the guide rails. The use of two guide rails together with the counterweight guiding arrangement according to the present disclosure may thus give good horizontal support for the counterweight. This in turn, can manifest itself as improved ride comfort in the elevator car and reduced war of elevator components.

[0044] In some applications it might be possible to combine the counterweight guiding arrangement according to the present disclosure with other counterweight guiding arrangements. For example, in addition to a counterweight guiding arrangement as presented here, a guiding arrangement with only one roller wheel could be used.

[0045] In one aspect, a roller guide is disclosed. It is characterized in that it is configured to be used in the counterweight guiding arrangement according to the current disclosure. A roller guide according to the present disclosure can be a separate component to a counterweight. It can be replaced a number of times during the lifetime of the elevator or counterweight in which is it used. It is also possible to replace roller wheels without replacing the whole roller guide.

[0046] In one aspect, a counterweight for an elevator is disclosed. It is characterized in that it is configured to incorporate at least one roller guide according to the current disclosure. The roller guide can be completely outside the counterweight. The roller guide is often attached to the counterweight structures through bolts or screws. In embodiments where such attachment is used, the installation points in the counterweight comprise installation holes that are meant for attaching the roller guide. One roller guide can be attached through, for example, two, three or four screws or bolts, depending on the design specifics of the counterweight. Alternatively, it might be possible to weld the roller guide on the counterweight.

[0047] In one embodiment, the counterweight according to the current disclosure comprises a counterweight frame, the counterweight frame comprising two side beams, each side beam having one or more openings for positioning of at least one roller guide according to the current disclosure at each side beam of the counterweight frame. Many alternatives for constructing a counterweight frame are known in the art. The counterweight frame is usually made of steel parts welded together. In addition to the side beams, a counterweight frame typically comprises at least one cross beam extending in horizontal direction. Further, other components, such as attachment mechanism for hoisting roping are present. The weight of the counterweight is adjusted with fillers or other high-density objects that are mounted at the counterweight frame.

[0048] The roller guide according to the present disclosure can be installed through an installation hole in a side beam of a counterweight frame. Often, roller guides are positioned outside the counterweight frame. However, space for the counterweight in the vertical direction is limited, as it needs to have the same range of motion as the elevator car. At the same time be heavy enough to fulfil its balancing purpose. Due to stability reasons and limited space in the horizontal direction, also the counterweight thickness is restricted. This means that it would be desirable to allocate as much vertical space in the counterweight as possible for the fillers. When the roller guides can be installed at the side beam, space in the top and bottom part of the counterweight is freed and more fillers can be used in the counterweight. Consequently, when the volume available for the fillers increases, the density requirement for the filler material can be laxed in some applications. This might allow the use of concrete instead of steel or cast iron as filler material. This widens the range of applications where cheaper filler material, such as concrete, can be used.

[0049] The openings in the side beams are sites at which the roller wheels can cross the side beam. It is possible that the roller wheels are mounted on the outside of the counterweight. Due to their size, they might need more space than is available between the side beam and the guide rail. Alternatively, the roller wheels might protrude from the inside of the counterweight frame to the outside through the openings in order to make contact with the guide rail.

[0050] Each opening at the side beam of the counterweight can accommodate one roller guide. Alternatively, one roller guide can be positioned through two or more openings. It is also possible that two or more roller guides

can be positioned through one opening. The shape and size of the openings can vary according to the application. The opening can have a round, rounded, oval or tetragonal shape, for example. The stability of the counterweight frame has to be taken into account when designing the size, shape and number of the openings in each specific application. The design of these features can be determined by the skilled person.

[0051] The extent to which the roller guide is inside the counterweight frame can vary according to the application. It is possible that only the part of the roller wheel that is necessary for contacting the guide rail remains outside of the counterweight frame. Alternatively it is possible that the guide frame is anchored on the inside of the counterweight frame and the remainder of the roller guide is external to the counterweight. Any positioning between, and including, these extremes is possible for the roller guide and for the counterweight guiding arrangement according to the present disclosure. In one embodiment, the roller guide(s) partially protrude outside the counterweight frame through the opening(s). A partially protruding roller guide means that part of its structure is inside the guide frame while a part is on the outside. At least a part of the roller wheels is typically outside the counterweight frame as the roller wheels need to make contact with the guide rail. In other respects, the structuring and positioning of the guide roller can vary. An example of a roller guide partially protruding outside the counterweight frame is a roller guide having half of each roller wheel and the heads of screws going through the installation holes outside the counterweight frame while the guide frame is on the inside. In one embodiment, the guide frame is enclosed in the counterweight frame. In another embodiment, in addition to the above-mentioned parts, a part of the guide frame is outside the counterweight frame.

[0052] In all situations, enough play needs to be left around moving parts to avoid unwanted contacts between the components of the elevator system. The margins are largely specified in construction and elevator safety codes and the skilled person is able to take such aspects into account.

[0053] In one aspect, an elevator is disclosed. The elevator is characterized in that it comprises a counterweight guiding arrangement according to the current disclosure. In one aspect, the use of the counterweight guiding arrangement according to the current disclosure is disclosed.

DESCRIPTION OF DRAWINGS

[0054] Fig. 1 presents a counterweight guiding arrangement according to the present disclosure. The arrangement is seen in the direction of the roller guide 20 movement. The figure depicts a cross section of a guide rail 10 that comprises two lateral portions 11. A guide groove 12 is formed between the two lateral portions 11 and each lateral portion comprises a guide groove-facing surface 13. In addition to the part of the guide groove 12 that is limited by the oblique guide groove-facing surfaces 13, the guide groove 12 can be understood to comprise also the narrower part near the bottom. Thus, in this embodiment, the guide groove-facing surfaces 13 have two bends to different directions. The guide groove-facing surface 13 thus comprises a shoulder. By an oblique surface is meant the portion of the guide groove-facing surface 13 that not form a right angle to either of the adjacent surfaces. The roller wheels 22 move along the oblique part of the guide groove-facing surfaces 13. The angle between these parts is approximately 65°. The guide rail 10 is constructed from profiled steel.

[0055] The roller guide 20 in Fig. 1 comprises two roller wheels 22. The roller wheels 22 are drawn partly behind a cross section of a counterweight side beam 32, which has at least one hole 33 (not shown in Fig. 1) for positioning the roller wheels 22. The roller wheels 22 have a curved profile. This means that, when viewed in the direction of the roller guide 20 movement, the guide rail-contacting surface of the roller wheels 22 appears rounded. The roller wheels 22 could alternatively have a flat profile, meaning that in the same viewing direction, they would appear as a quadrangles or a quadrangles with rounded corners. In other words, in the flat-profiled roller wheels 22, the contact area between the guide rail 10 and the roller wheel 22 is substantially as wide as the roller wheel 22. However, also in an embodiment where the roller wheel 22 profile is curved, the said contact surface can be wider than depicted in Fig. 1. This depends on the elasticity or softness of the roller wheel 22 material, which can vary between embodiments.

[0056] The angle between the roller wheels 22 and the guide groove-facing surface 13 that they touch deviates from a right angle. This angle is determined by the plane of rotation 23 of the roller wheels 22, which is depicted in Fig.1 by a dashed line. Also the angle between the two roller wheels 22 is determined by the planes of rotation 23 of the roller wheels 22. In the embodiment of Fig. 1, also this angle deviates from a right angle. The angle is approximately 85°. However, the counterweight guiding arrangement according to the present disclosure could be embodied also by one or both of the above-mentioned angles being right angles.

[0057] The projections of the roller wheels 22 on a plane perpendicular to the direction of the roller guide 20 movement overlap partially. In other words, the roller wheels 22 are arranged one after the other and tilted sideways in respect to their movement direction, so that they cross. This crossed orientation offers possibility for space saving in the construction of a counterweight guiding arrangement. In this embodiment, the crossing point of the two roller wheels 22 is closer to the surfaces along which they move than the midpoint (i.e. the axles) of the roller wheels 22.

[0058] Each roller wheel 22 has an axle and is attached to the fastening means 25 of the guide frame 21 from one end of the axle. In this embodiment, the fastening

means 25 is a hole 25 in the guide frame 21. is Many alternatives for realizing this attachment are known in the art and a skilled person is able to select an appropriate one. The axle, its bearings and other design details follow known designs. It is possible to envisage guide frame 21 structures, where the roller wheel 22 axle is fastened from its both ends to the guide frame 21.

[0059] The guide frame 21 in the embodiment of Fig. 1 comprises two installation means 26 for attaching the roller guide 20 to the counterweight frame 31. The installation means 26 in this case are holes 26 in the guide frame 21. The side beam 32 of the counterweight 30 has corresponding installation points 34, which also are holes 34. The two installation means 26 are in mirrored positions in the guide frame 21. The roller guide 20 in the embodiment of Fig. 1 thus has two positions from which it is attached to the side beam 32. A bolt 40 is fitted through holes 26, 34 and the attachment between the guide frame 21 and the side beam 32 is secured by tightening a nut 41 fitted on the bolt 40.

[0060] The roller guide 20 of Fig. 1 further comprises two elastic elements 24, which in this case are helical springs 24. The springs 24 are located at the two installation means 26. The bolt 40 is placed inside the spring 24 and the spring 24 remains between the guide frame 21 and the nut 41. The tensioning of the spring 24 can be adjusted by tightening the nut 41.

[0061] Figs 2A and 2B present a roller guide 20 according to the present disclosure seen from two different perspectives. In Figs 2A and 2B, the structure of the guide frame 21 is presented in more detail. The guide frame 21 comprises two wing-like portions 21' whose surfaces are substantially in the same plane. The installation means 26 attaching the roller guide 20 to the counterweight 30 (not shown) are located in the wing-like portions 21'. The wing-like portions 21' are connected by a partly asymmetrical central portion 21a, 21b. The central portion has a first part 21a and a second part 21b. The first part 21a is a substantially flat metal piece comprising fastening means 25 for a first roller wheel 22. The second part 21b is a continuation of the first part 21a, but it is bent relative to the first part 21a. The bend is sideways in respect to the direction of the roller guide movement. The second part 21b comprises a second fastening means 25 for a second roller wheel 22. The angle between the planes of rotation 23 for the two roller wheels 22 is determined by the extent to which the second part 21b is bent relative to the first part 21a.

[0062] In another embodiment, both parts 21a, 21b of the guide frame 21 could be bent. The angle between each wing-like portion 21' and the respective part 21a, 21b of the guide frame 21 is then adjusted accordingly.

[0063] Fig. 3 presents a counterweight 30 being attached to roller guides 21 according to the present disclosure. The counterweight 30 in Fig. 3 comprises a counterweight frame 31 with two side beams 32. It also comprises a horizontally extending cross beam 35 and an attachment mechanism for hoisting roping 36. The second cross beam 35 has been removed for visualization.

[0064] The counterweight 30 has a roller guide 20 according to the present disclosure mounted in the vicinity of the top end the counterweight of each side beam 32. The top end is the end of the counterweight that faces upwards in the using position of the counterweight. Correspondingly, the bottom end of the counterweight is the end that faces downwards in the using position of the counterweight. Although not shown in Fig. 3, another roller guide 20 is mounted in the vicinity of the bottom end of each side beam 32 in a similar manner. The counterweight in Fig. 3 thus has four guide rollers 20 mounted at the counterweight frame 31. The guide rollers 20 are in the vicinity of each corner of the counterweight 30.

[0065] The counterweight 30 of Fig. 3 is configured to run between two guide rails 10 (not shown). The guide groove 12 of each guide rail 10 is positioned so that the roller wheels 22 of the roller guides 21 touch the guide groove-facing surfaces 13 of the lateral portions 11 as presented in Fig. 1.

[0066] Each side beam 32 has two openings 33 for each roller guide 20. The openings approximately follow the outline of the roller wheel 22. The opening 33 is made slightly larger than the roller wheel 22 to avoid the roller wheel 22 touching the counterweight frame 31. The openings can optionally be larger than depicted in Fig. 3. It would also be possible to provide one larger opening 33 to accommodate both roller wheels 22 of a single roller guide 20.

[0067] As is visible in Fig. 3, the guide rollers 20 in the top end of the counterweight 30 are in the same horizontal level with the attachment for hoisting roping 36, which in this case is a pulley.

[0068] Fig. 4 depicts the side beam 32 of Fig. 3 seen from the inside of the counterweight 30 at a position of a roller guide 20 according to the present disclosure.

[0069] Both wing-like portions 21' are clearly visible in Fig. 4. Also the bolts 40 and the nuts 41 used for securing the attachment between the guide frame 21 and the side beam 32 are visible. They indicate the location of the installation means 26 on the guide frame 21 and the installation point 34 on the side beam 32, respectively, as detailed for Fig. 1.

[0070] In one alternative embodiment, each wing-like portion could comprise two installation means 26, corresponded by installation points 34 in the counterweight 30. Further, the wing-like portions 21' do not deed to be in one plane as in this embodiment. They can have various extensions allowing the variable positioning of the installation means 26 on the side beam 32. The variation in the shape and size of the wing-like portions 21' allows the use of a higher number of installation means 26 in a single wing-like portion 21', for example.

[0071] The first part 21a of the guide frame 21 is largely visible in Fig. 4. Since the first part 21a is tilted in respect to the viewing direction, it partly covers the second part 21b, hiding the fastening means 25 of one of the roller wheels 22.

[0072] Fig. 5 depicts the top end of a counterweight 30 and a counterweight guiding arrangement according to the present disclosure in the direction of the counterweight 30 movement.

[0073] In the guide rail 10 of this embodiment, the guide groove-facing surfaces 13 of the lateral portions 11 have a straight cross section. The guide groove-facing surfaces 13 meet at the center of the guide groove 12 (not marked) cross section. The lateral portions 11 of the guide rail 10 have a bipartite structure, comprising symmetrical lateral extensions 11' in addition to the guide groove 12 forming structures. The structure of the roller guides 21, situated on each side of the counterweight 30, is as described above.

[0074] In this figure, both of the two guide rails 10 between which the counterweight 30 is configured to move are visible. The supporting forces conveyed by each roller guide 21 and buffered by the elastic elements 24 result in the dampening of horizontal movement of the counterweight 30. Since the guide rails 10 are opposite to each other, the supporting forces from the guide rails 10 have partially opposite directions. This enhances the stabilizing effect of the counterweight guiding arrangement according to the present disclosure.

[0075] In the embodiment of Fig. 5, the attachment for hoisting roping 36 is tilted relative to the counterweight 30. However, the positioning of the attachment for hoisting roping 36 does not affect the counterweight guiding arrangement and any type of attachment of the hoisting roping 36 can be used.

[0076] Fig. 6 presents a detail of a counterweight frame 31 and a counterweight guiding arrangement of Fig 5. The angle between the guide groove-facing surfaces 13 is 80 degrees.

[0077] Fig. 7 is a schematic presentation of some possible embodiments of a guide rail 10 according to the present disclosure.

[0078] In panels a)-d), f) and g), the guide groove-facing surfaces 13 have a straight cross section.

[0079] In panel a), the guide groove-facing surfaces 13 meet at the center of the guide groove 12 cross section connecting the two lateral portions 11. The angle between the guide groove-facing surfaces 13 is approximately 100°.

[0080] In panel b), guide rail 10 has a bottom, which has a width of approximately 10 % of the guide groove 12 width. The angle between the guide groove-facing surfaces 13 is approximately 75°.

[0081] In panel c), the guide rail 10 has a bottom, which has a width of approximately 40 % of the guide groove 12 width. The angle between the guide groove-facing surfaces 13 is approximately 75°.

[0082] In panel d), the guide rail 10 has a bottom. In addition to the bottom, the lateral portions 11 are connected by another structure on the opposite side of the guide rail 10 cross section relative to the guide groove 12.

[0083] In panel e), the guide groove-facing surfaces 13 have two bends and the bottom of the guide groove 12 connects the two lateral portions 11.

[0084] In panel f), the guide rail has a bottom. In addition to the bottom, the lateral portions 11 are connected by another structure as in panel d). The bottom is wider than the guide groove 12 is deep.

[0085] In panel g), the lateral portions 11 of the guide rail 10 have a bipartite structure, comprising symmetrical lateral extensions 11' in addition to the guide groove 12 forming structures.

[0086] In panel h), the guide groove-facing surfaces 13 are partly curved and have a bend. The guide groove 12 comprises a bottom connecting the two lateral portions 11.

[0087] In panel i), the guide groove-facing surfaces 13 are curved for their whole cross section.

[0088] Fig. 8 depicts some possible roller wheel 22 profiles. The roller wheels 22 are viewed in the direction of their movement and the axle is depicted by the two bulges on opposite sides of the roller wheels 22. The diameter of the axle relative to the diameter of the roller wheel 22 can vary, as can be seen by comparing the roller wheels 22 in panels a) - c). In panel a), the roller wheel 22 has a curved profile. In panel b), the roller wheel 22 has a flat profile. in panel c) the roller wheel 22 has a flat profile with two bends. The bends can be used to match a corresponding bend in the guide groove-facing surface 13 of a guide rail 10. In panel d), the roller wheel 22 has a flat profile. The roller wheel is asymmetrical and the flat profile appears sloped in this viewing direction.

[0089] The above embodiments are to be understood as illustrative examples of the invention. Further embodiments of the invention are envisaged. It is to be understood that any feature described in relation to any one embodiment may be used alone, or in combination with other features described, and may also be used in combination with one or more features of any other of the embodiments, or any combination of any other of the embodiments. Furthermore, equivalents and modifications not described above may also be employed without departing from the scope of the invention, which is defined in the accompanying claims.

Claims

1. A counterweight guiding arrangement for an elevator, comprising at least one guide rail (10), at least one roller guide (20) configured to move along the guide rail (10), the guide rail (10) comprising two lateral portions (11) defining a guide groove (12) therebetween, the guide groove (12) extending in the direction of the roller guide (20) movement, the roller guide (20) comprising a guide frame (21) and at least two roller wheels (22) attached to the guide frame (21), each of the roller wheels (22) having a plane of rotation (23), **characterized in that**

   - each of the roller wheels (22) is configured to

move along a guide groove-facing surface (13) of one of said lateral portions (11), so that each said guide groove-facing surface (13) has at least one roller wheel (22) configured to move thereon;
- there are at least two planes of rotation (23) of the roller wheels (22), the planes of rotation (23) being at an angle to each other; and
- the projections of the roller wheels (22) on a plane perpendicular to the direction of the roller guide (20) movement overlap at least partially.

2. The counterweight guiding arrangement according to claim 1, wherein each roller wheel (22) is in contact only with one said guide groove-facing surface (13).

3. The counterweight guiding arrangement according to claim 1 or 2, wherein the angle between the at least two planes of rotation (23) of the roller wheels (22) is 40° - 110°, preferably 60° - 90°.

4. The counterweight guiding arrangement according to any of the preceding claims, wherein the guide frame (21) comprises at least one elastic element (24) for springing the roller guide (20).

5. The counterweight guiding arrangement according to claim 4, wherein the at least one elastic element (24) is an elastic spacer or a spring, such as a helical spring or a leaf spring, or an integrated spring achieved through local elasticity of the roller guide (20).

6. The counterweight guiding arrangement according to any of the preceding claims, wherein each of the guide groove-facing surfaces (13) of the lateral portions (11) has a straight cross section.

7. The counterweight guiding arrangement according to claim 6, wherein there is an angle between the guide groove-facing surfaces (13) of the guide rail (10) and the angle is 80° - 110°, preferably 85° - 100°.

8. The counterweight guiding arrangement according to any of the preceding claims, wherein the plane of rotation (23) of at least one of the roller wheels (22) is substantially at a right angle relative to the guide rail-facing surface (13) of the lateral portion (11) that it is configured to move on.

9. A roller guide (20), **characterized in that** it is configured to be used in the counterweight guiding arrangement according to any of the preceding claims.

10. A counterweight (30) for an elevator, **characterized in that** it is configured to incorporate at least one roller guide (20) according to claim 9.

11. A counterweight (30) according to claim 10, wherein the counterweight comprises a counterweight frame (31), the counterweight frame (31) comprising two side beams (32), each side beam (32) having one or more openings (33) for positioning of at least one roller guide (20) according to claim 9 at each side beam (32) of the counterweight frame (31).

12. The counterweight (30) according to claim 10 or 11, wherein the roller guide(s) (20) partially protrude outside the counterweight frame (31) through the openings (33).

13. The counterweight (30) according to claim 10-12, wherein the guide frame (21) is enclosed in the counterweight frame (31).

14. An elevator,**characterized in that** it comprises a counterweight guiding arrangement according to any of claims 1-8.

15. The use of the counterweight guiding arrangement according to any of claims 1-8.

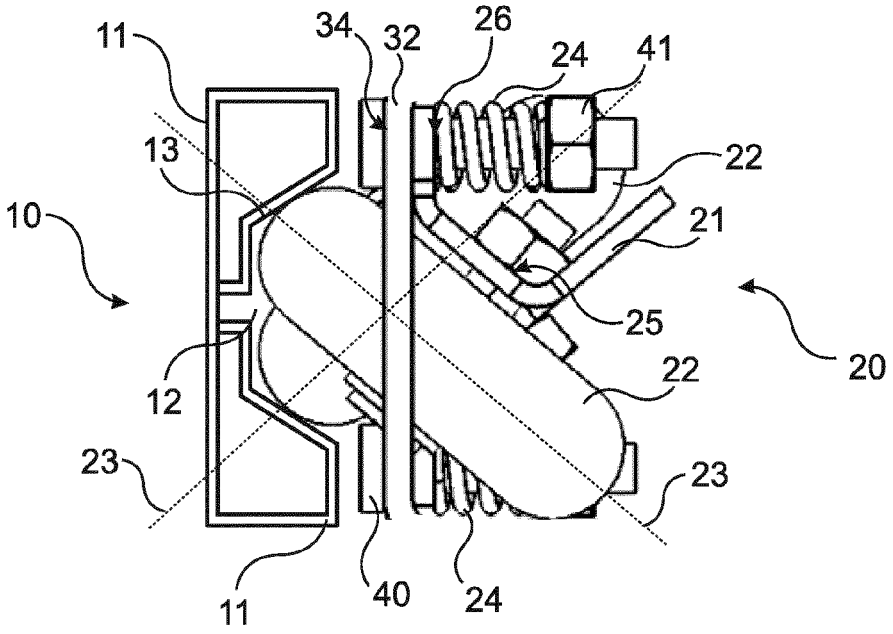

FIG. 1

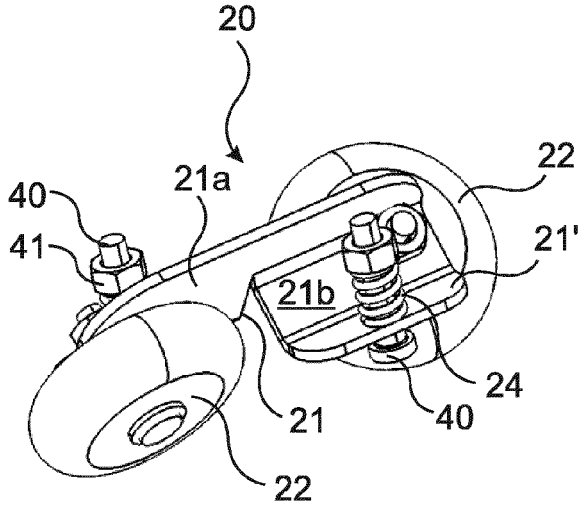

FIG. 2A

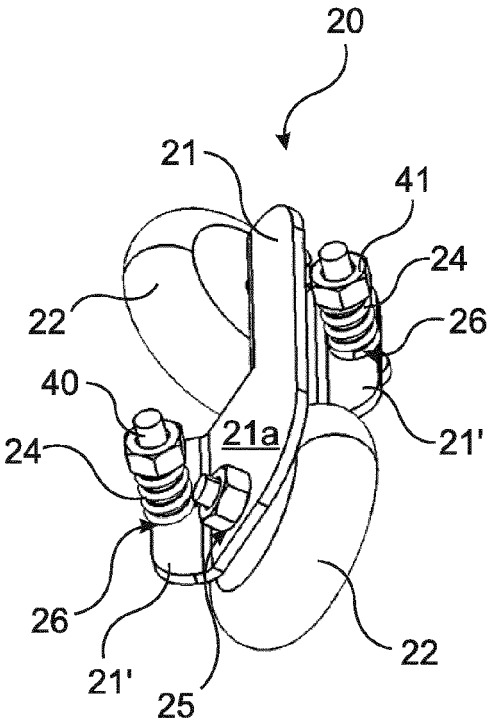

FIG. 2B

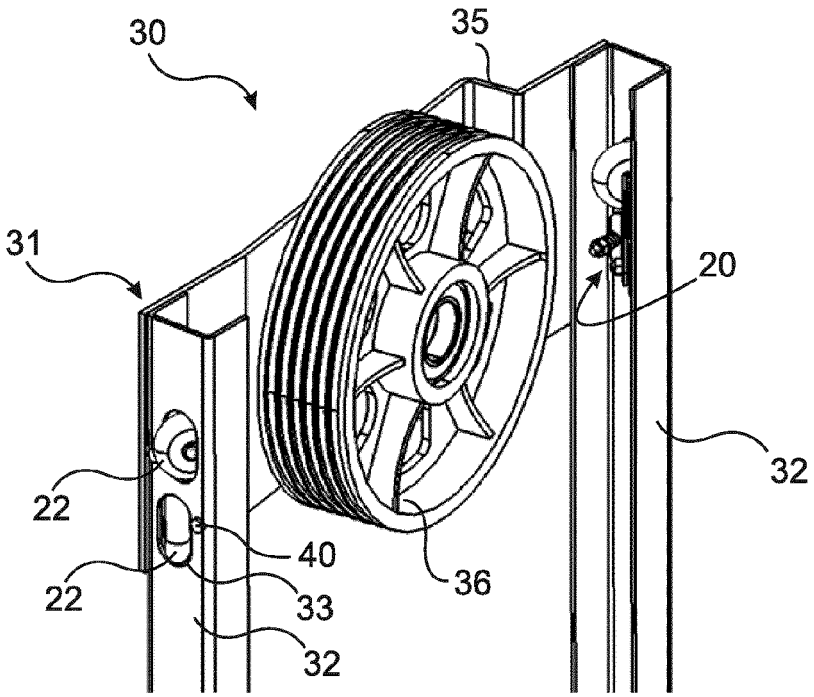

FIG. 3

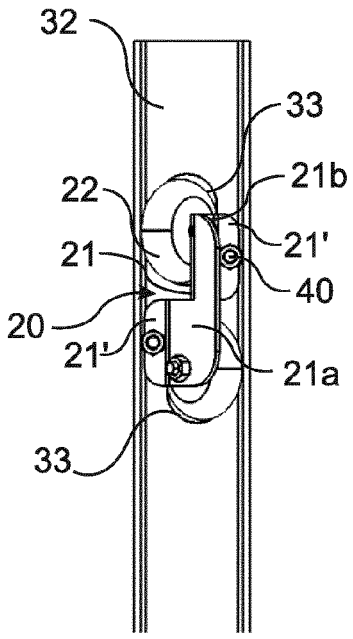

FIG. 4

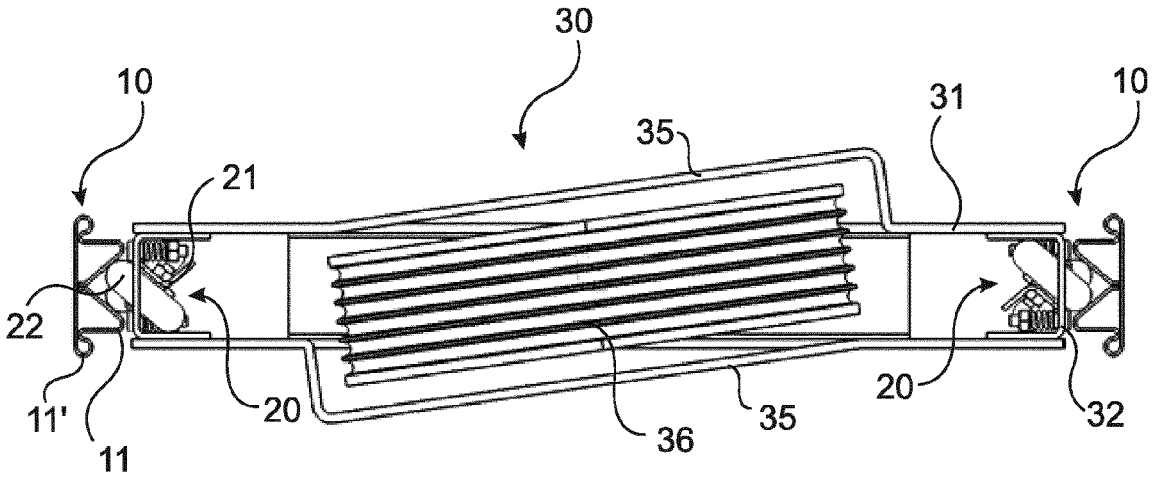

FIG. 5

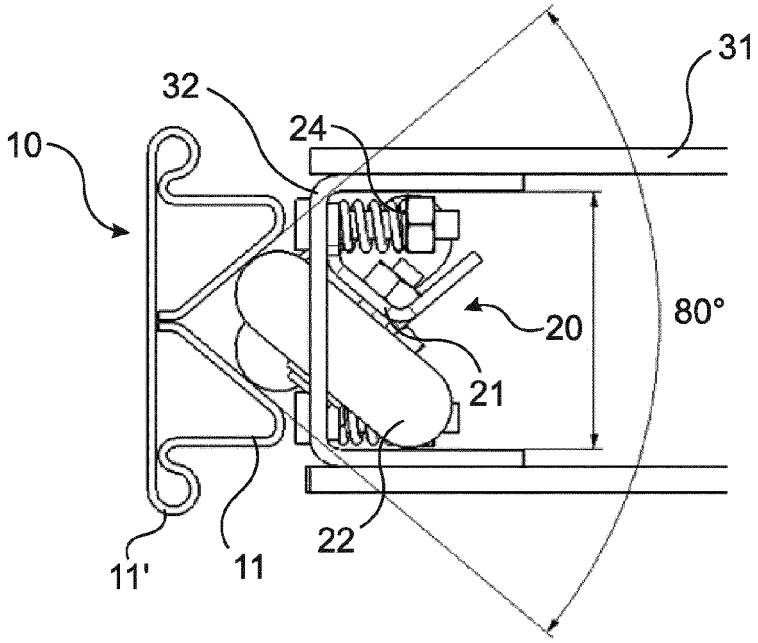

FIG. 6

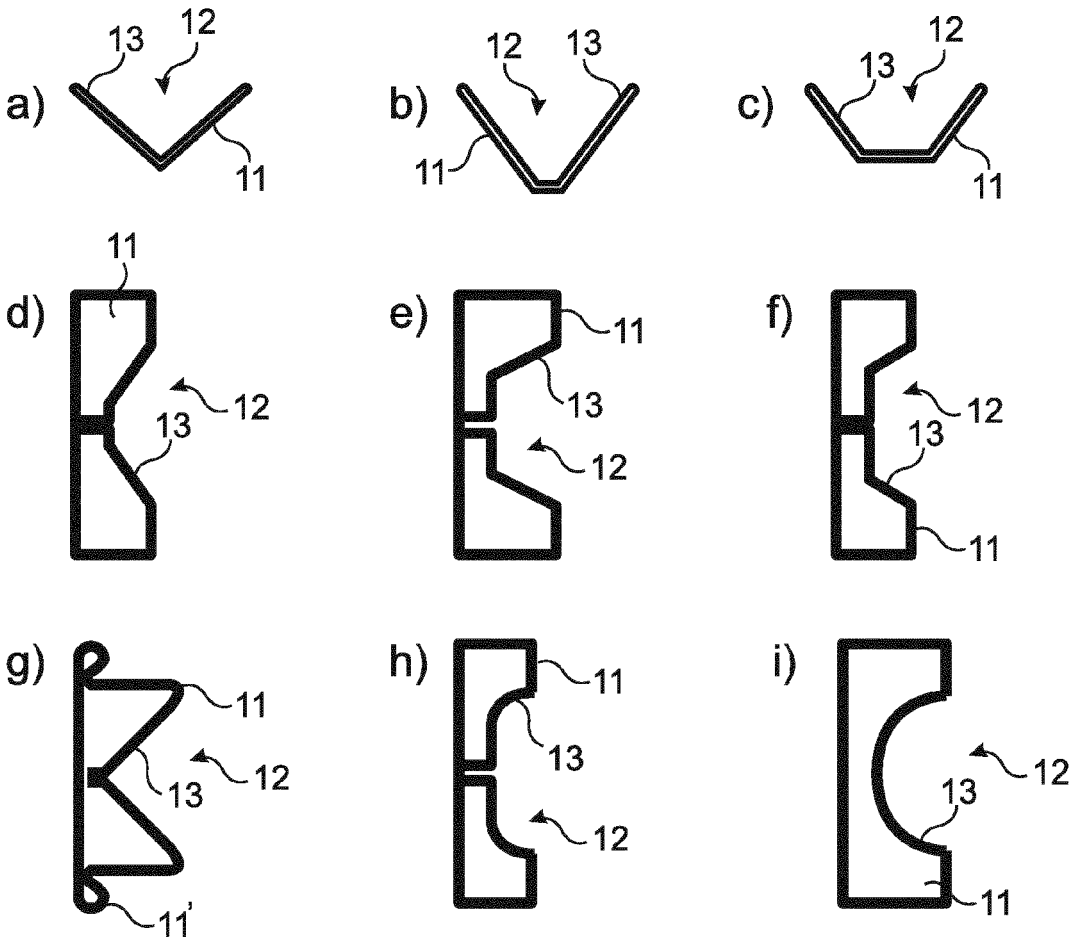
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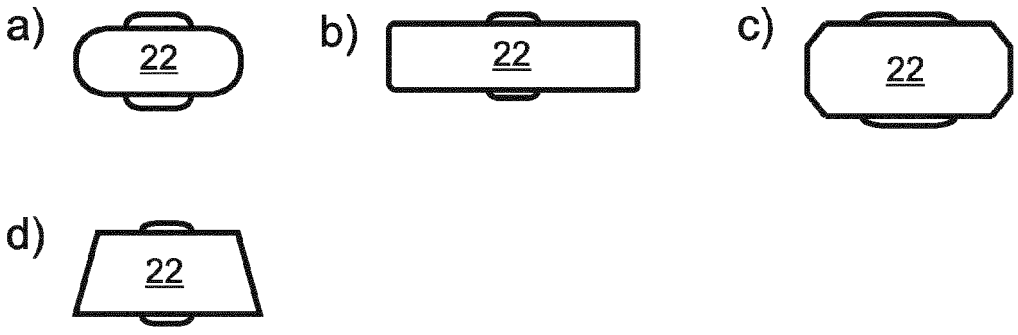
FIG. 7


a)
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d)
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FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 14 19 1575

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 April 2015	Oosterom, Marcel

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