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

(11) **EP 2 904 182 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
28.09.2016 Bulletin 2016/39

(21) Application number: **14809952.6**

(22) Date of filing: **05.11.2014**

(51) Int Cl.:
E06B 9/58 *(2006.01)*

(86) International application number:
PCT/GB2014/053292

(87) International publication number:
WO 2015/075422 (28.05.2015 Gazette 2015/21)

(54) **METHOD OF MANUFACTURING A GUIDE RAIL FOR A SCREEN**

VERFAHREN ZUR HERSTELLUNG EINER FÜHRUNGSSCHIENE FÜR EINEN BILDSCHIRM

MÉTHODE DE FABRICATION D'UN RAIL DE GUIDAGE POUR UN ÉCRAN

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **21.11.2013 GB 201320553**

(43) Date of publication of application:
12.08.2015 Bulletin 2015/33

(73) Proprietor: **Ideas By Design Ltd**
Cadwell Lane
Hitchin
Hertfordshire SG4 0SB (GB)

(72) Inventor: **DIBBEN, Martin**
Hitchin
Hertfordshire SG04 0SB (GB)

(74) Representative: **Evens, Paul Jonathan et al**
Maguire Boss
24 East Street
St. Ives, Cambridgeshire PE27 5PD (GB)

(56) References cited:
EP-A1- 2 335 956
WO-A1-2009/098433
CN-U- 202 325 184

EP 2 904 182 B1

Printed by Jouve, 75001 PARIS (FR)

Description

TECHNICAL FIELD

[0001] The present invention relates generally to guided screen systems of the kind employing a screen with a zip-like retention device on each lateral side thereof, and particularly but not exclusively to a method of manufacturing a rail for guiding one lateral side of a screen with a zip-like retention device.

BACKGROUND ART

[0002] Each guided screen system comprises a roller blind and a pair of guide rails disposed on either side of an aperture to be screened. The roller blind comprises a roller with a blind fabric wound therearound. The blind fabric has flexible strips on its lateral sides which are trapped within, but free to slide along, a specially shaped groove or keyway in each of the rails. With such a configuration, the blind fabric is held laterally between the rails as it is deployed from the roller. US 4638844 and GB 2235005 disclose early forms of such a screen system, with different brackets for loosely mounting the guide rail; and WO2009/098433 discloses a current form of such a screen system. Each flexible strip typically is one half of a zipper, but could be manufactured by moulding a soft or semi-rigid high polymer such as hot-melt synthetic resin or rubber. The important point is that each flexible strip has or forms an enlarged head region (at least in use) which slides along the keyway, but resists being pulled transversely out of the keyway. Such a flexible strip is hereinafter referred to as a zip-like retention device or simply "half zipper", and a roller blind with such flexible strips for engaging corresponding rails is hereinafter referred to as a zip-like guided screen, regardless of whether one half of a zipper is actually used.

[0003] Conventional zip-like guided screens typically have relatively coarse half zippers for engaging the rail keyways (i.e. half zippers with teeth at least 1.5mm thick). Such relatively coarse half zippers may be securely retained in appropriately sized rail keyways, sufficient at least for most internal installations. However, such relatively coarse half zippers are often thicker than the blind fabric, and this can lead to a number of problems. For example, when wound onto the roller, the half zippers take up more room in a radial direction than the blind fabric, thereby necessitating the use of bigger housings than would be required to fit the blind fabric alone. Also, when winding the blind fabric onto its roller, there is a tendency for the half zippers to spiral with an axial spread, rather than in a single plane, which conflicts with the aim of retaining the blind fabric between the rails. When the blind fabric and half zipper spirals to one side, the blind fabric is tilted to that one side which may cause the weight bar on the bottom of the blind fabric (hem bar) to tilt meaning it is no longer level. If the spiral abuts an adjacent surface, the blind fabric may then start to spiral in the opposite direction, so tilting the blind fabric and hem bar in a counter direction. This cycle repeats until the blind is fully raised.

[0004] The blinds of such conventional zip-like guided screens also suffer from wrinkling at the edge, where the half zipper is welded/attached to the blind fabric. This wrinkling is caused by the difference in blind build-up on the roller between the single thickness of the blind fabric (between the half zippers) and the greater thickness of the half zippers at the edges. The differences in thickness cause stretching of the blind fabric at the edges which is seen as wrinkling when the blind is deployed. In a similar way, there is a difference in blind build-up diameter between the blind fabric in the middle and the half zippers at the edge, causing stress in the blind fabric when wound on the roller between the tight roll at the edges (because of the thickness of the half zippers) and the loose roll in the middle (between the between the half zippers). Such stress may cause creasing in the blind fabric on the roller, particularly when relatively thin blind fabrics are used and with larger blinds.

[0005] In an attempt to overcome some of the problems of relatively coarse half zippers, the use of relatively fine half zippers (i.e. half zippers with teeth less than 1.5mm thick) has been contemplated. However, even when such relatively fine half zippers are used with rails with correspondingly sized keyways, there is a tendency for the blind fabric to pull all too easily its relatively fine half zippers away from the rails. This tendency remains even when the keyway was lined with specially shaped inserts. Hence, the relatively fine half zippers are considered to provide insufficient anchorage in their respective rail keyways.

[0006] EP2335956 discloses a screen with zip-like guiding and holding elements on each lateral side thereof for movement along respective slots formed in a pair of opposed guiding rails. Each guiding rail comprises an outer part of aluminium and an inner part of extruded plastics material. The outer part has a substantially "U'-shaped cross-section, and the inner part has a substantially "C"-shaped cross-section. The inner part is resiliently compressed and retained in the outer part to form a keyway with a narrow slot for engaging the zip-like guiding and holding elements.

[0007] The present applicant has sought to provide an improved method of manufacturing the rail in order to reduce the tendency for a screen with a zip-like retention device to pull out from its keyway.

STATEMENT OF INVENTION

[0008] In accordance with a first aspect of the present invention, there is provided a method of manufacturing a guide rail for a zip-like guided screen, comprising: providing an elongate body including a pair of spaced-apart walls defining a channel therebetween, each wall having a flange projecting laterally into the channel to define a neck region of the channel; and plastically deforming the

elongate body to reduce the neck region of the channel from a first width to a second width such that the channel defines a keyway for receiving a zip-like retention device, the keyway having a profile which is maintained on completion of the plastic deformation and configured to allow the zip-like retention device to slide in a first direction along the channel, and to resist movement in a second direction perpendicular to the first direction which would separate the zip-like retention device from the elongate body.

[0009] The present applicant has appreciated that, with such a two-step process, it is possible to control very precisely the dimensions of the neck region of the channel in the resulting guide rail, without increasing costs substantially. Such precision may be difficult to achieve economically when manufacturing a guide rail in a conventional manner, for example by extrusion alone.

[0010] The first width may be at least 1.0mm, perhaps even about 2.0mm. The second width may be less than 1.0mm, and may even be 0.8mm or less, such as 0.6mm. In this way, it is possible to manufacture commercially guide rails for use with relatively coarse half zippers and even relatively fine half zippers.

[0011] The elongate body may have a base portion supporting the pair of spaced-apart walls, the base portion having a line of weakness which defines a hinge region when deforming the elongate body to reduce the neck region of the channel from the first width to the second width. The line of weakness may lie in a plane midway between the pair of spaced-apart walls. In this way, one part of the elongate body on one side of the line of weakness may rotate relative to another part of the elongate body on an opposite side of the line of weakness when deforming the elongate body. For example, one part may rotate relative to the other part through an angle of at least 10 degrees, perhaps even at least 15 degrees, for example about 20 degrees.

[0012] The amount of plastic deformation between successive elongate bodies may be varied so as to manufacture bodies having differing second widths.

[0013] The elongate body may be formed from a metal, such as aluminium. The step of providing an elongate body may comprise the step of extruding the elongate body.

[0014] In the method, deforming the elongate body may comprise passing the elongate body through a roller jig, the roller jig having roller means to clamp a first part of the elongate body and at least one press roller to urge a second part of the elongate body against the first part when reducing the neck region of the channel from the first width to the second width. The roller jig may further comprise a stop member for limiting position of the at least one press roller to control width reduction of the neck region.

[0015] The resulting guide rail may be used in a screen system, such as those disclosed in US 4638844, GB 2235005 and WO2009/098433 (the contents of which are herein incorporated by reference), where the guide rail is resiliently mounted in a support frame to help maintain tension in the blind fabric during deployment. Thus, the present invention also extends to a method of fabricating a screen system, comprising: resiliently mounting in a support frame a guide rail manufactured in accordance with the first aspect of the present invention; and providing a roller blind comprising a roller with a blind fabric wound therearound, the blind fabric having a zip-like retention device on one lateral side thereof which is configured to slide along the channel in the guide rail in an axial direction and resist being pulled out of the channel in a direction transverse to the axial direction as the blind fabric is deployed from the roller. Resiliently mounting the guide rail in the support frame helps to maintain tension in the blind fabric during deployment when the support frame is secured to a surface such as a wall surrounding a window or door.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] An embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figure 1 shows a perspective view of an elongate body for use in the manufacture of a guide rail for a zip-like guided screen, in accordance with one embodiment of the present invention;

Figure 2 is a cross-sectional view of the elongate body of Figure 1;

Figures 3A and 3B show respectively perspective and cross-sectional views of the elongate body of Figure 1 once deformed into a one type of guide rail;

Figures 4A and 4B show respectively perspective and cross-sectional views of the elongate body of Figure 1 once deformed into another type of guide rail;

Figure 5 shows a schematic, partially exploded view of a roller jig for deforming the elongate body of Figure 1 ; and

Figure 6 shows an end view of the roller jig of Figure 5.

DETAINED DESCRIPTION OF SPECIFIC EMBODIMENT

[0017] Figure 1 shows an elongate body or rail 10 for use in the manufacture of a guide rail for a zip-like guided screen (not shown). The elongate body 10 includes a pair of spaced-apart walls 12,14 upstanding from a base portion 16. The pair of spaced-apart walls 12,14 (which are inclined away from each other, with the angular separation being about 20°) define therebetween an open channel 18. Each wall 12,14 has a flange 20 projecting laterally into the channel 18 to define a neck region 22 which has an initial minimum width W_1 of about 2.0mm. The base portion 16 includes a groove 24 extending in a notional plane midway between the pair of spaced-

apart side walls 12,14. The groove 24 provides a line of weakness in the base portion 16, defining a hinge region 26 adjacent the groove 24 in the base portion 16. Such an elongate body 10 is readily formed in aluminium using a conventional extrusion process.

[0018] Figures 3A, 3B, 4A and 4B show the elongate body 10 after it has been plastically deformed to narrow the width of the neck region 22 from the initial width W_1 to a reduced width W_2. During deformation, one part 30 of the elongate body 10 on one side of the hinge region 26 rotates permanently through an angle (α), which may for example be about 20°, relative to another part 32 of the elongate body 10 on the opposite side of the hinge region 26. Once the elongate body 10 has been deformed, the walls 12,14 define a keyway 40 for receiving a zip-like retention device, the keyway having a profile configured to allow the zip-like retention device to slide in a first direction Y along the channel 18, and to resist movement in a second direction Z perpendicular to the first direction which would separate the zip-like retention device from the elongate body 10. In Figures 3A and 3B, the angle (α) that the one part 30 is rotated relative to the other part 32 is about 20°, and the reduced width W_2 is about 0.6mm, which means the resulting keyway 40 is suitable for use with relatively fine half zippers (i.e. half zippers with teeth less than 1mm thick).

[0019] Moreover, by varying the amount of plastic deformation, rails having differing neck widths can be produced from the same extrusion 10. Thus, as shown in figures 4A and 4B, the angle (α) that the one part 30 is rotated relative to the other part 32 is about 18°, and the reduced width W_2 is about 0.8mm, which means the resulting keyway 40 is suitable for use with relatively coarse half zippers (i.e. half zippers with teeth at least 1mm thick.

[0020] One way of deforming the elongate body 10 to achieve the aforementioned reduction in the neck region 22 of the channel 18 will now be described by way of example with reference to Figures 5 and 6. Figure 5 illustrates schematically a roller jig 50 for width reduction of the neck region 22 of the channel 18. The roller jig 50 comprises two sets of rollers 52,54 which are spaced apart and define a passageway therebetween. At least one set of the rollers 52,54 is actively rotated (e.g. by drive spindle 55) to drive the elongate body 10 through the roller jig 50, and at least one set of the rollers 52,54 is resiliently biased towards the other set to exert a clamping force therebetween. As the elongate body 10 is driven in direction X through the passageway of the roller jig 50, the rollers 52,54 engage and support a portion of the elongate body 10 including the wall 12. At the same time, a set of press rollers 56 are urged against another portion of the elongate body including the wall 14 to deform the elongate body 10 in order to reduce the width of the neck region 22 of the channel 18. The set of press rollers 56 are mounted on an arm 58 which is pivoted at one end which is downstream of the sets of rollers 52,54. An adjustable stop 60 is provided to limit the inclination of arm 58 relative to the sets of rollers 52,54, and hence control the extent of deformation in the elongate member 10. By changing the position of the adjustable stop 60, the roller jig 50 can be controlled so that the width W_2 of the neck region 22 is reduced to the required dimension.

[0021] The roller jig 50 is provided with interchangeable rollers 52, 54 to accommodate elongate bodies with different cross-sections.

Claims

1. A method of manufacturing a guide rail for a zip-like guided screen, comprising:

   providing an elongate body (10) including a pair of spaced-apart walls (12,14) defining a channel (18) therebetween, each wall (12,14) having a flange (20) projecting laterally into the channel (18) to define a neck region (22) of the channel; **characterized by**:

   plastically deforming the elongate body (10) to reduce the neck region (22) of the channel (18) from a first width to a second width such that the channel defines a keyway (40) for receiving a zip-like retention device, the keyway (40) having a profile which is maintained on completion of the plastic deformation and is configured to allow the zip-like retention device to slide in a first direction along the channel (18), and to resist movement in a second direction perpendicular to the first direction which would separate the zip-like retention device from the elongate body (10).

2. A method according to claim 1, in which the first width is at least 1.0mm.

3. A method according to claim 1 or claim 2, in which the second width is less than 1.0mm.

4. A method according to any one of the preceding claims, in which the elongate body (10) has a base portion (16) supporting the pair of spaced-apart walls (12,14), with the base portion (16) having a line of weakness (24) which defines a hinge region (26) when deforming the elongate body (10) to reduce the neck region (22) of the channel (18) from the first width to the second width.

5. A method according to claim 4, in which one part of the elongate body (10) on one side of the line of weakness (24) rotates through an angle of at least 10 degrees relative to another part of the elongate body (10) on an opposite side of the line of weakness (24) when deforming the elongate body (10).

6. A method according to any preceding claim and comprising the step of providing successive elongate bodies and varying the amount of plastic deformation between successive bodies so as to manufacture bodies having differing second widths.

7. A method according to any one of the preceding claims, in which the elongate body (10) is formed from a metal, such as aluminium.

8. A method according to any one of the preceding claims, in which the step of providing an elongate body (10) comprises the step of extruding the elongate body.

9. A method according to any one of the preceding claims, in which deforming the elongate body comprises passing the elongate body (10) through a roller jig (50), the roller jig having roller means (52,54) to clamp a first part of the elongate body and at least one press roller (56) to urge a second part of the elongate body (10) against the first part when reducing the neck region (22) of the channel (18) from the first width to the second width.

10. A method according to claim 9, in which the roller jig (50) further comprises a stop member (60) for limiting position of the at least one press roller (56) to control width reduction of the neck region.

11. A method of fabricating a screen system, comprising:

resiliently mounting in a support frame a guide rail manufactured in accordance with any one of claims 1-10; and
providing a roller blind comprising a roller with a blind fabric wound therearound, the blind fabric having a zip-like retention device on one lateral side thereof which is configured to slide along the channel in the guide rail in an axial direction and resist being pulled out of the channel in a direction transverse to the axial direction as the blind fabric is deployed from the roller.

Patentansprüche

1. Verfahren zur Herstellung einer Führungsschiene für einen reißverschlussartig geführten Sichtschutz, umfassend: Bereitstellen eines länglichen Körpers (10), der ein Paar beabstandete Wände (12, 14) einschließt,
die einen Kanal (18) dazwischen definieren, wobei jede Wand (12, 14) einen Flansch (20) aufweist, der seitlich in den Kanal (18) hineinsteht, um einen Halsabschnitt (22) des Kanals zu definierten; **gekennzeichnet durch**:
plastisches Verformen des länglichen Körpers (10), um den Halsabschnitt (22) des Kanals (18) von einer ersten Breite auf eine zweite Breite zu reduzieren, sodass der Kanal eine Schlüsselführung (40) zur Aufnahme einer reißverschlussartigen Haltevorrichtung definiert, wobei die Schlüsselführung (40) ein Profil aufweist, das nach Abschluss des plastischen Verformens beibehalten wird und konfiguriert ist, um es der reißverschlussartigen Haltevorrichtung zu ermöglichen, in einer ersten Richtung entlang des Kanals (18) zu gleiten und einer Bewegung in eine zweite zu der ersten Richtung senkrechten Richtung zu widerstehen, die die reißverschlussartige Haltevorrichtung von dem länglichen Körper (10) trennen würde.

2. Verfahren nach Anspruch 1, bei dem die erste Breite mindestens 1,0 mm beträgt.

3. Verfahren nach Anspruch 1 oder Anspruch 2, bei dem die zweite Breite weniger als 1,0 mm beträgt.

4. Verfahren nach einem der vorhergehenden Ansprüche, bei dem der längliche Körper (10) einen Basisabschnitt (16) aufweist, der das Paar beabstandete Wände (12, 14) stützt, wobei der Basisabschnitt (16) eine Schwächungslinie (24) aufweist, die bei der Verformung des länglichen Körpers (10) zum Reduzieren des Halsbereichs (22) des Kanals (18) von der ersten Breite auf die zweite Breite eine Verbindungsregion (26) definiert.

5. Verfahren nach Anspruch 4, bei dem sich bei dem Verformen des länglichen Körpers (10) ein Teil des länglichen Körpers (10) auf einer Seite der Schwächungslinie (24) um einen Winkel von mindestens 10 Grad in Bezug auf einen anderen Teil des länglichen Körpers (10) auf einer gegenüberliegenden Seite der Schwächungslinie (24) dreht.

6. Verfahren nach einem der vorhergehenden Ansprüche und umfassend den Schritt des Bereitstellens aufeinanderfolgender länglicher Körper und des Variierens des Umfangs an plastischer Verformung zwischen aufeinanderfolgenden Körpern, um Körper herzustellen, die verschiedene zweite Breiten aufweisen.

7. Verfahren nach einem der vorhergehenden Ansprüche, bei dem der längliche Körper (10) aus einem Metall, zum Beispiel Aluminium, gebildet ist.

8. Verfahren nach einem der vorhergehenden Ansprüche, bei dem der Schritt des Bereitstellens eines länglichen Körpers (10) den Schritt des Extrudierens des länglichen Körpers umfasst.

9. Verfahren nach einem der vorhergehenden Ansprüche, bei dem das Verformen des länglichen Körpers das Durchführen des länglichen Körpers (10) durch eine Rollenvorrichtung (50) umfasst, wobei die Rollenvorrichtung Rollenmittel (52, 54), um einen ersten Teil des länglichen Körpers festzuklemmen, und mindestens eine Druckwalze (56), um einen zweiten Teil des länglichen Körpers (10) gegen den ersten Teil zu drücken, wenn der Halsabschnitts (22) des Kanals (18) von einer ersten Breite auf eine zweite Breite reduziert wird, aufweist.

10. Verfahren nach Abschnitt 9, bei dem die Rollenvorrichtung (50) ferner ein Anschlagelement (60) zum Begrenzen der Position der mindestens einen Druckwalze (56) umfasst, um die Breitenreduktion des Halsbereichs zu steuern.

11. Verfahren zur Fertigung eines Sichtschutzsystems, umfassend:

elastisches Montieren einer Führungsschiene in einem Tragrahmen, die nach einem der Ansprüche 1-10 hergestellt wurde; und
Bereitstellen eines Rollos, die eine Rolle mit einem darum gewundenen Vorhangstoff umfasst, wobei der Vorhangstoff eine reißverschlussartige Haltevorrichtung auf einer lateralen Seite davon aufweist, die konfiguriert ist, um entlang des Kanals in der Führungsschiene in einer axialen Richtung zu gleiten und dem widersteht, in einer zu der axialen Richtung transversalen Richtung aus dem Kanal gezogen zu werden, wenn der Vorhangstoff von der Rolle abgewickelt wird.

Revendications

1. Procédé de fabrication d'un rail de guidage d'un écran à guidage de type glissière, consistant à : concevoir un corps allongé (10) comprenant deux parois espacées (12, 14)
définir un canal (18) entre ces dernières, chaque paroi (12, 14) comportant un rebord (20) faisant saillie latéralement dans le canal (18) pour définir une région de col (22) du canal ; **caractérisée par** :
une déformation plastique du corps allongé (10) de façon à réduire la région de col (22) du canal (18) d'une première largeur à une seconde largeur telle que le canal définisse une rainure (40) destinée à recevoir un dispositif de retenue de type glissière, la rainure (40) ayant un profil qui est maintenu lors de la déformation plastique et étant conçue pour permettre au dispositif de retenue de type glissière de glisser dans une première direction le long du canal (18), et pour résister à un déplacement dans une seconde direction perpendiculaire à la première direction qui pourrait séparer le dispositif de retenue de type glissière du corps allongé (10).

2. Procédé selon la revendication 1, dans lequel la première largeur est d'au moins 1,0 mm.

3. Procédé selon la revendication 1 ou la revendication 2, dans lequel la seconde largeur est inférieure à 1,0 mm.

4. Procédé selon l'une quelconque des revendications précédentes, dans lequel le corps allongé (10) comporte une partie base (16) supportant les deux parois espacées (12, 14), la partie base (16) présentant une ligne de moindre résistance (24) qui définit une région d'articulation (26) lors de la déformation du corps allongé (10) de façon à réduire la région de col (22) du canal (18) de la première largeur à la seconde largeur.

5. Procédé selon la revendication 4, dans lequel une partie du corps allongé (10) située d'un côté de la ligne de moindre résistance (24) pivote sur un angle d'au moins 10 degrés par rapport à une autre partie du corps allongé (10) située d'un côté opposé de la ligne de moindre résistance (24) lors de la déformation du corps allongé (10).

6. Procédé selon l'une quelconque des revendications précédentes, et comprenant l'étape consistant à concevoir des corps allongés successifs et à faire varier la quantité de déformation plastique entre les corps successifs de façon à fabriquer des corps ayant des secondes largeurs qui diffèrent.

7. Procédé selon l'une quelconque des revendications précédentes, dans lequel le corps allongé (10) est formé d'un métal, tel que d'aluminium.

8. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'étape consistant à concevoir un corps allongé (10) comprend l'étape consistant à extruder le corps allongé.

9. Procédé selon l'une quelconque des revendications précédentes, dans lequel la déformation du corps allongé consiste à faire passer le corps allongé (10) dans un gabarit à rouleaux (50), le gabarit à rouleaux comportant des moyens formant rouleaux (52, 54) destinés à brider une première partie du corps allongé et au moins un rouleau presseur (56) destiné à pousser une seconde partie du corps allongé (10) contre la première partie lors de la réduction de la région de col (22) du canal (18) de la première largeur à la seconde largeur.

10. Procédé selon la revendication 9, dans lequel le gabarit à rouleaux (50) comprend en outre un élément de butée (60) destiné à limiter la position de l'au

moins un rouleau presseur (56) de façon à maitriser la réduction de largeur de la région de col.

11. Procédé de fabrication d'un système d'écran consistant à :

effectuer un montage élastique, dans un cadre de support, d'un rail de guidage fabriqué selon l'une quelconque des revendications 1 à 10 ; et utiliser un store à rouleau comprenant un rouleau autour duquel est enroulée une toile, la toile comportant un dispositif de retenue de type glissière sur son premier côté latéral qui est conçu pour glisser le long du canal du rail de guidage dans une direction axiale et pour résister à un arrachement du canal dans une direction transversale à la direction axiale lors du déploiement de la toile à partir du rouleau.

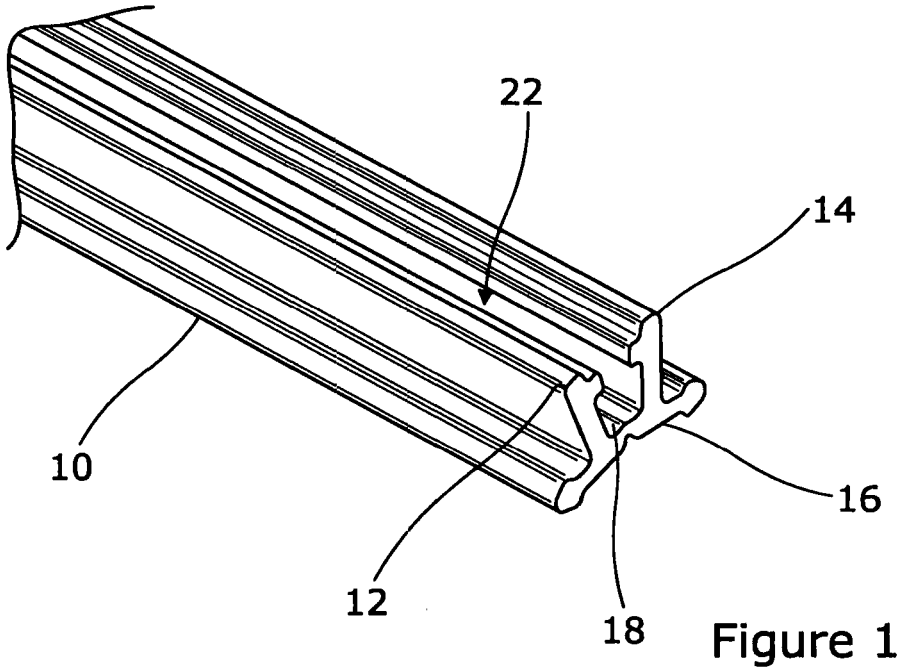

Figure 1

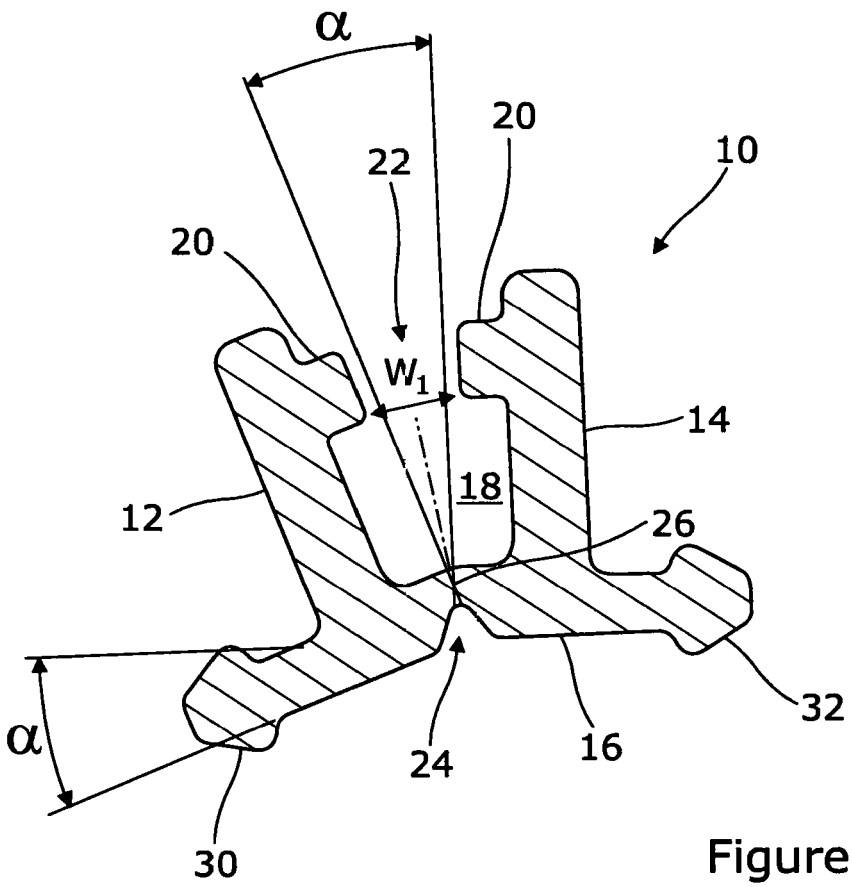

Figure 2

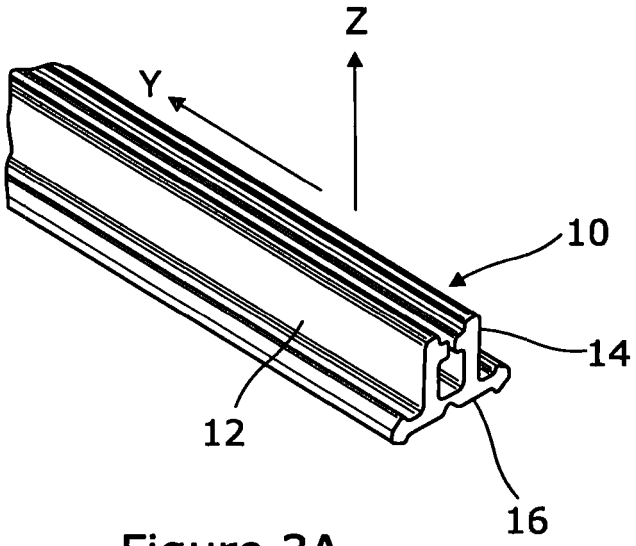

Figure 3A

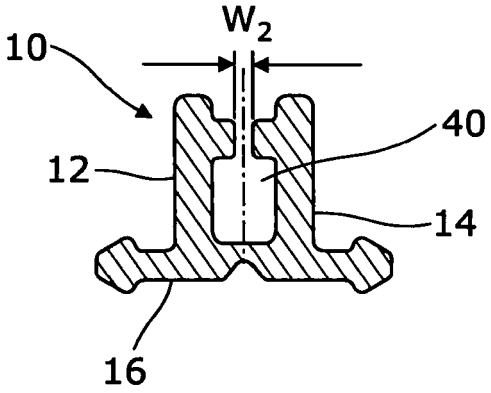

Figure 3B

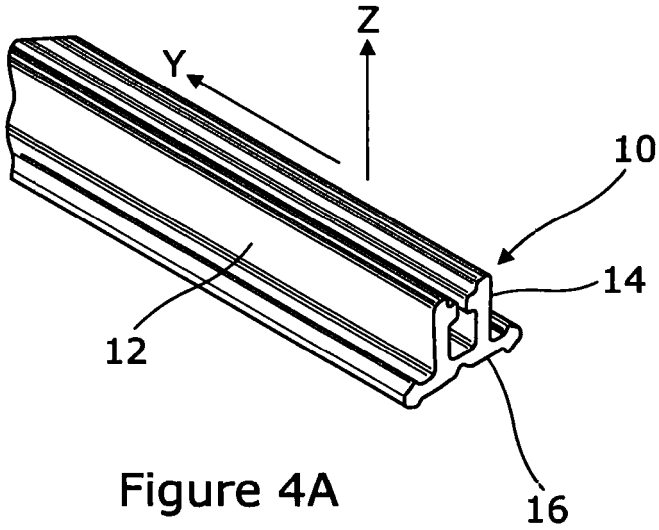

Figure 4A

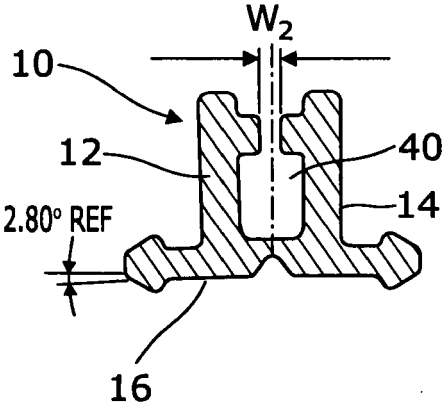

Figure 4B

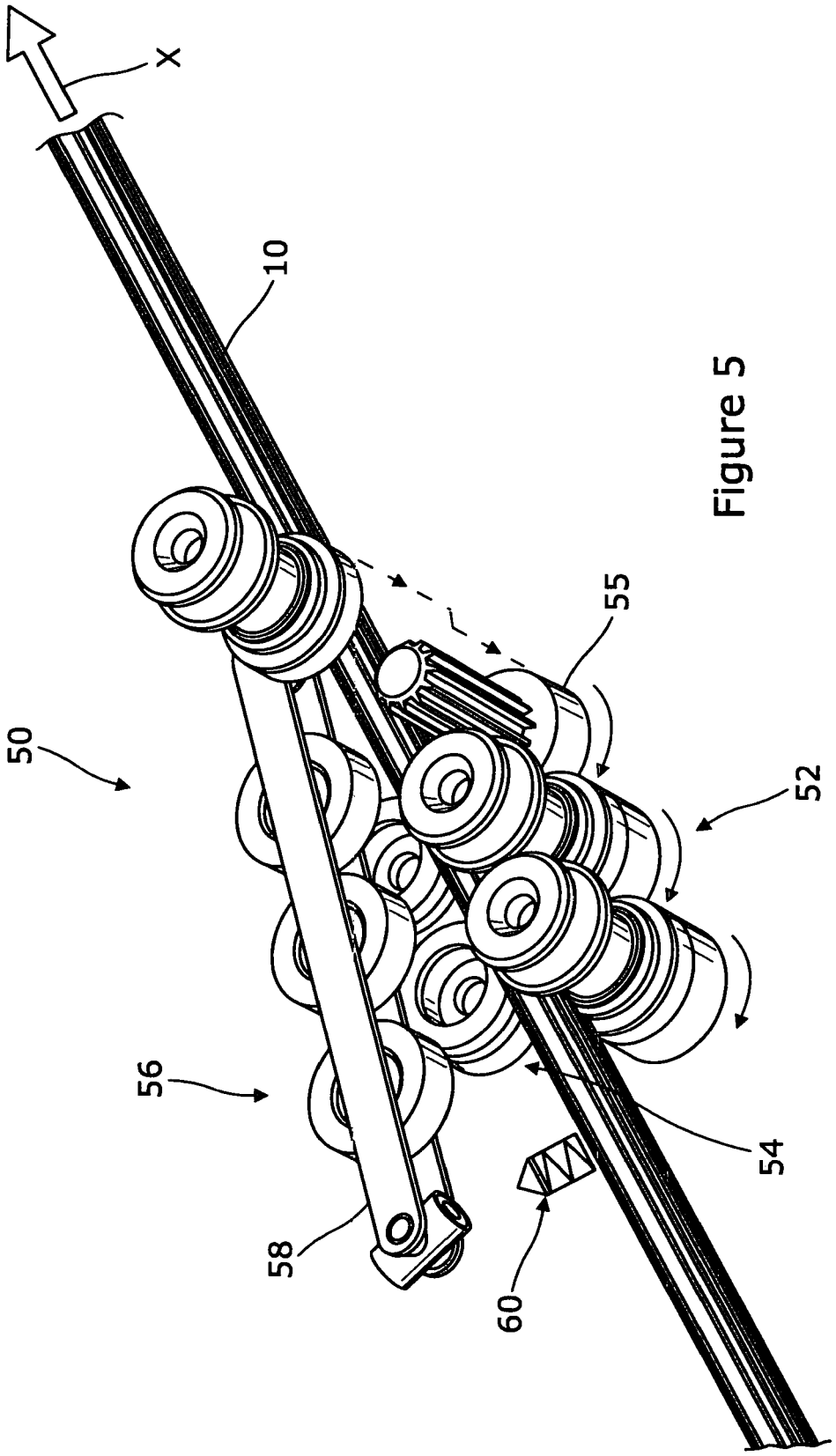

Figure 5

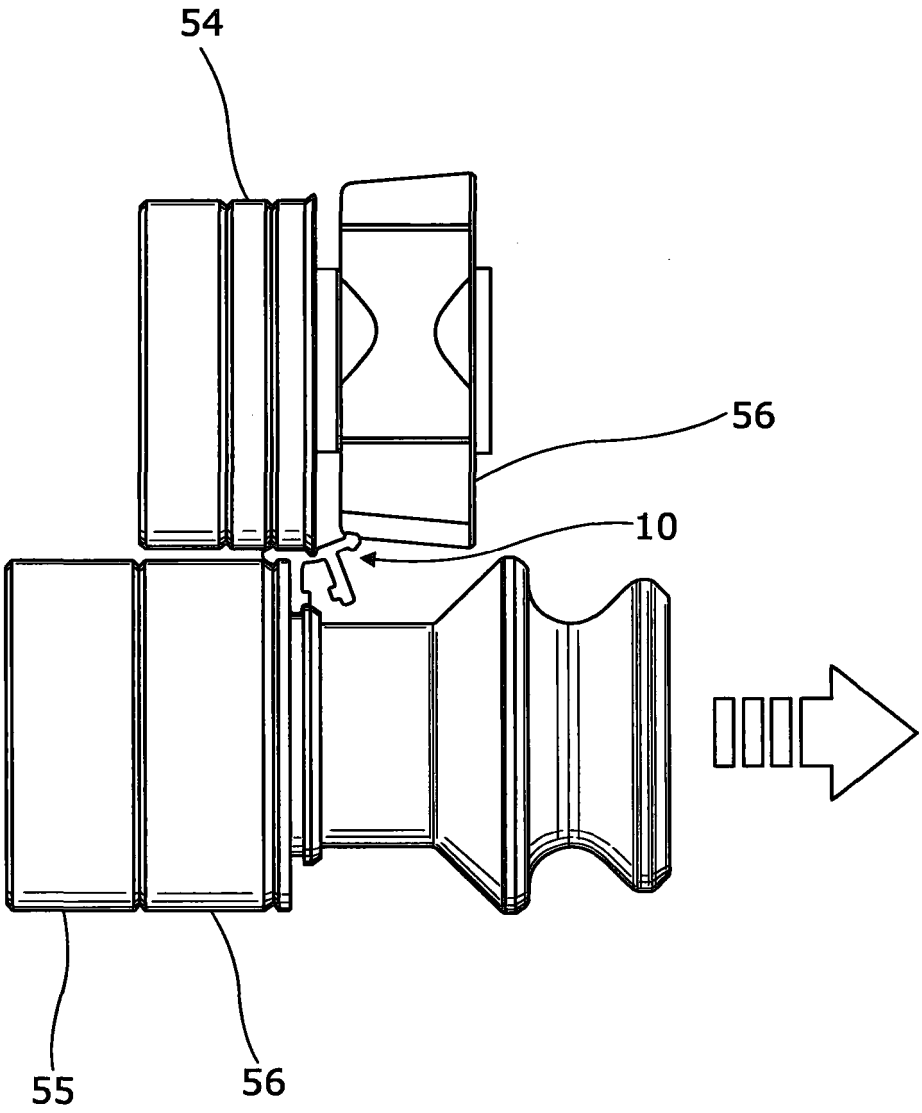

Figure 6

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 4638844 A **[0002] [0015]**
- GB 2235005 A **[0002] [0015]**
- WO 2009098433 A **[0002] [0015]**
- EP 2335956 A **[0006]**