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

(11) EP 2 952 654 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.12.2015 Bulletin 2015/50

(51) Int Cl.:
E04G 21/32 *(2006.01)* ***A62B 35/00*** *(2006.01)*
E06C 7/18 *(2006.01)*

(21) Application number: **15170456.6**

(22) Date of filing: **03.06.2015**

(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
Designated Extension States:
BA ME
Designated Validation States:
MA

(30) Priority: **04.06.2014 SE 1400282**

(71) Applicant: **ATL Limited**
2010 Fgura (MT)

(72) Inventor: **HEDLUND, Rolf**
792 00 MORA (SE)

(74) Representative: **Ehrner & Delmar Patentbyrå AB**
Box 10316
100 55 Stockholm (SE)

(54) SAFETY RAIL AND TRAVELLER AND SAFETY SYSTEM FOR PREVENTING FALL

(57) A safety rail (2) included in a system for protecting a person from fatal falls from a structure is arranged for fastening along passage (21,22,23) on the structure, wherein the safety rail (2) is arranged for co-operation with a moveable traveller (3) having a fastener (4) for co-operation with the safety line, and wherein the safety rail (2) exhibits means for locking the traveller (3) in a locking direction (S). The safety rail exhibits on one edge a plurality of hook elements (7) each one with a hook surface (8) directed essentially opposite to the locking direction (S) for locking engagement with the traveller (3). A second edge has alternating inward bends (6) and outward protrusions (5). Each inward bend (6) and each hook element (7) are positioned opposite to each other, and each outward protrusion (5) is positioned opposite to a portion (10) between two hook elements (7). The invention also relates to a traveller and a system.

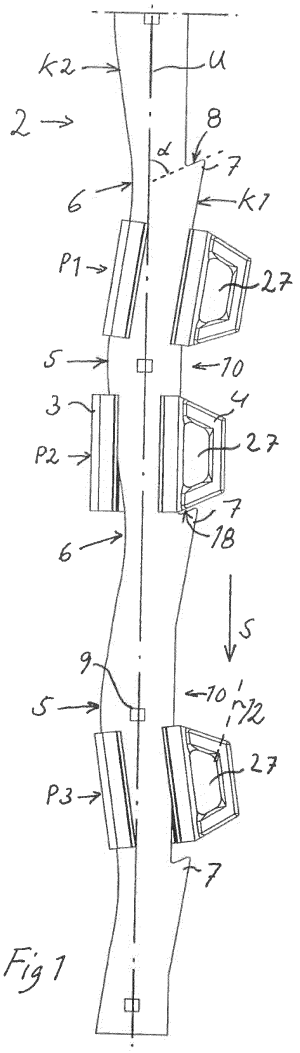


Fig 1

EP 2 952 654 A1

Description

FIELD OF THE INVENTION

[0001] The invention relates to a safety rail being part of a system for preventing a person from falling, wherein the safety rail is arranged to be mounted along a passage on a structure, wherein the safety rail is arranged for co-operation with a moveable traveller having a fastener for co-operation with a safety line being connected to the person, and wherein the safety rail has means for locking the traveller in a locking direction. The invention also concerns a traveller and a safety system.

BACKGROUND OF THE INVENTION

[0002] It is widely previously known to arrange fastening devices for safety hooks for safety lines on building roofs in order to avoid fatal falls from said buildings. Such fastening points can be different types of safety railings, bracket fasteners, ladders etc. One problem with previously known fastening devices is that a roof worker has to manually replace his safety line when passing brackets and the like that interrupts the continuity of an elongate fastening device such as for example a railing.

[0003] In order to avoid such problems it is previously known two arrange safety wires with specialized spaced fastening devices and travellers that are constructed such that they can automatically pass such a fastening device without having to disengage the with. This arrangement is, however, expensive and complicated and not faultless in every situation.

[0004] As examples of the background art can be mentioned US 2010/0012426 A1 and US 4,269,284.

AIM AND MOST IMPORTANT FEATURES OF THE INVENTION

[0005] It is an aim of the present invention to provide a safety rail and a system and a traveller as mentioned initially wherein the problems of the background art are at least reduced.

[0006] This aim is achieved with a safety rail included in a system for protecting a person from fatal falls from a structure, wherein the safety rail is elongated and generally strip shaped and arranged for fastening along passage on the structure, wherein the safety rail comprises a first and a second longitudinal edge, wherein the safety rail is arranged for co-operation with a moveable traveller having a fastener for co-operation with the safety line being connected to said person, and wherein the safety rail exhibits means for locking the traveler in a locking direction. The invention is distinguished in that the first longitudinal edge exhibits a plurality of hook elements each one with a hook surface directed essentially opposite to the locking direction for locking engagement with a portion of the traveller, that the second longitudinal edge extends with a stretched-out meander shape with alternating inward bends and outward protrusions, that each inward bend and each hook element are positioned opposite to each other, and that each outward protrusion is positioned opposite to a portion between two hook elements. These hook elements are hereby neighboring.

[0007] By the hook elements on the first longitudinal edge in combination with the particular extended meander shape on the second longitudinal edge it is achieved that the traveller, during passage on an outward protrusion is aligned respectively displaced sideways respectively angled such that the traveller will effectively come into locking engagement with the hook surface of a neighboring hook element.

[0008] The safety line is thereby effectively blocked after already a very short movement of the traveller, whereby the falling person will be effectively caught. In particular, the outward protrusions of the safety rail will provide a displacement of a falling or uncontrolled downwardly moving traveller in the direction of safely being able to be caught by the hook surface.

[0009] This is because the entire traveller will be displaced sideways by the outward protrusion such that the portion of the traveller being subject to engagement with the hook surface will be displaced closer to a portion of the safety rail between two hook elements. During the continued fast fall movement, the traveller will thereupon be maintained in such a position relative to the safety rail. A further function of the outward protrusions is a tendency of re-angling the traveller relative to the safety rail resulting in effective engagement with the hook surface and avoiding that the worker is injured.

[0010] An important advantage of the invention is that a traveller without moveable parts can be used for providing the locking. Hereby problems are avoided related to parts jamming because of intrusion of dirt, freezing water etc. The construction will become robust, reliable and economically advantageous. One great advantage is for use on masts, wherein very long safety rails can be installed in a simple manner and at a low cost. Loops surrounding ladders for safety reasons can be dispensed with.

[0011] As preferred alternatives, the second longitudinal edge extends shallow sinus-shaped or shallow zigzag-shaped or in a meander curve form described by circular arc portions or in a combination of these alternatives.

[0012] The hook surface forms an open angle opposite to the locking direction to an extension direction of the safety rail, wherein said angle is an acute angle and preferably between 60° and 90° to the extension direction.

[0013] It is suitable that the safety rail exhibits means for attachment thereof on a roof ladder, a building wall, a mast or a bracket arrangement. Said means are suitably fastening holes for passage of fastening elements, protruding angle arms or bolts etc.

[0014] The invention also relates to a traveller included in a system for protecting a person from fatal falls from a structure, wherein the traveller exhibits a fastener for

co-operation with a safety line being connected to the person, wherein the traveller is arranged to be moveable along a safety rail according to the above and the traveller is arranged to be locked in a locking direction on the safety rail. According to the invention, the fastener is arranged on a portion of the traveller being positioned sideways of and essentially in line with an main plane through a space for form-fitting reception of the safety rail. The traveller exhibits a portion for locking engagement with hook elements being arranged on a first longitudinal edge of the safety rail having each one a hook surface being directed essentially opposite to the locking direction.

[0015] Advantages corresponding to the safety rail are obtained with respect to the inventive traveller.

[0016] Suitably the traveller along its length is provided with an opening to said space for passage of fastening means during movement of the traveller along the safety rail. With "length" is here intended in parallel with a main direction of the traveller and with the general direction of the extension of a safety rail when the traveller is aligned therewith.

[0017] Furthermore, the traveller exhibits an extension of said space opposite to said opening for the passage of screw/rivet heads/nuts etc.

[0018] The fastener preferably has a cut-out with an extension in a direction in parallel with a main direction of said space for allowing that a fastening means of the safety line is moveably received in respect of said main direction of the traveller.

[0019] The cut-out is suitably a slot whereof a first portion, being closest to said portion for locking engagement, extends essentially crosswise to said main direction, and whereof a second portion forms an acute angle with said main direction, wherein a catch means for holding the fastening means of the safety line at tension forces up to a predetermined level is arranged in the region of the first portion. By adjusting the point of attachment of the point of action of the pulling force from the safety line on the traveller, convenient passage of the traveller past the hook elements can hereby be ensured. In case of a fall, in particular a fall with a higher speed component straight out from the safety rail, the fastening means of the safety line will, however, become free from the locking element such that the pulling force is re-localized to a part of the traveller at the greatest distance from the portion of the traveller intended for engagement with a hook surface such that safe engagement is guaranteed.

[0020] The cut-out can also be limited by a loop portion, which extends essentially along said main direction.

[0021] Also other arrangements for re-positioning the pulling force in case of a fall are within the scope of the invention.

[0022] Preferably the traveller carries an energy absorbing fall damper arranged between the traveller and the safety line in order to avoid harmful jerks in the safety line when it is stretched after a fall.

[0023] An inventive system for protecting a person from fatal falls from a structure includes at least one safety rail and one traveler according to the above. Advantages corresponding to the above are obtained in respect of the inventive system.

BRIEF DESCRIPTION OF DRAWINGS

[0024] The invention will now be described in a greater detail by way of embodiments and with reference to the annexed drawings, wherein:

Fig. 1 illustrates a system according to the invention with a traveller shown in different positions on a safety rail,
Fig. 2 shows the traveller in an end view,
Fig. 3 shows a system according to the invention arranged on a building structure,
Figs. 4a, b and c show an alternatively constructed traveller having a fall shock absorber in different positions, and
Fig. 5 shows further alternatively constructed traveller.

DESCRIPTION OF EMBODIMENTS

[0025] Like elements have been allotted the same reference numerals.

[0026] Fig. 1 illustrates a system according to the invention including a safety rail 2, whereon is form-fit positioned a traveller 3 with a fastener 4 for reception of a spring hook, a fastener means of bolt type or the like at the end of a safety line. Furthermore, the traveller 3 is shown in three different positions P1, P2 and P3 on the safety rail 2 for illustration of the inventive function which will be clarified in the following.

[0027] The safety rail 2 is generally elongated and strip-shaped such that it exhibits two wide sides, whereof one is shown in the side view in Fig. 1, and a first longitudinal edge K1 comprising a first thin side and a second longitudinal edge K2 comprising a second thin side of the safety rail 2.

[0028] The first longitudinal edge K1 comprises, at its side, a number of sideways protruding hook elements 7 distributed along its extension U, said hook elements 7 each comprising a hook surface 8 which is generally directed opposite to a locking directions S of the system. With locking direction S is intended that the traveller 3 is blocked against further movement in the direction S through engagement with a hook element 7.

[0029] From Fig. 1 is evident that each hook element 7 has a shallow flank allowing a traveller 3 to be moved conveniently passed the hook element 7 in a direction opposite to the locking direction S. The hook surface 8 is in the shown embodiment shown to be essentially plane and to form an angle α, which is open and preferably acute between 60° and 90° to an extension direction U of the safety rail 2 and against the locking direction.

[0030] Each inward bend 6 and each hook element 7 are positioned opposite to each other and each outward

protrusion 5 is positioned essentially opposite to a portion 10 between two hook elements. All together, the distance between outermost positioned points on the longitudinal sides K1 and K2 is in each cross section measured such, in relation to the dimension of the traveller, that the traveller is form-fit maintained on the safety rail 2 along its entire longitudinal extension.

[0031] In practice, hereby the degree of protrusion of the hook elements sideways corresponds to the degree of protrusion of the outward protrusions. The sideways dimension of the outward protrusions corresponds to the sideward distance between a line between the portion 10 and a line between the outermost ends of the hook elements.

[0032] The invention is most simply explained with reference to the positions P1, P2, P3 of the traveller 3 on the safety rail 2 shown in Fig. 1. In the uppermost position, P1, in Fig. 1, a part of the traveller 3 being opposite to the position of the fastener 4 has come to abut an upper flank of an outward protrusion 5. These results in a lining-up of the fastener 4 in the direction of angling the portion 18 of the traveller for engagement with a hook surface such at this portion 18 will be in direct proximity to a portion 10 between two protruding hook elements 7.

[0033] In the central position, P2, a traveller 3 has continued to move downwardly along the safety rail 2 and also an upper portion thereof has now been displaced such that the entire traveller 3 has been displaced to be essentially in direct vicinity of said portion 10 between two hook elements.

[0034] During the continued (uncontrolled) downward movement of the traveller caused by a fall, immediately following the central position, P2, of the traveller 3 in Fig. 1, the portion 18 will now immediately come into secure locking engagement with the hook surface 8, whereby further movement of the traveller 3 in the locking direction S is impossible. A person with a safety line connected to a traveller 3 will thereby be caught by the safety line and a fatal fall can be avoided.

[0035] The lower position, P3, in Fig. 1 of the traveller 3 illustrates how the traveller 3 can be brought to pass downwardly in a controlled manner passed a hook element 7 by letting the traveller move downwardly against an upward acting force from a safety line in the fastener 4 (shown with an interrupted line and indicated with 12).

[0036] Through the position of the fastener, the traveller 3 will now be tilted during its movement in the direction of the hook surface 8 such that the traveller 3 without problem can be brought to pass the hook element 7.

[0037] The fastener 4 has a cut-out 27 with an extension in the direction in parallel to a main direction H (see Fig. 5) of the space 17 (see Fig. 2, the main direction is at a right angle to the plane in Fig. 2) for allowing that a fastening means of the safety line is displaceably received in respect of the traveller in said main direction.

[0038] The cut-out 27 is limited by a loop-shaped portion, which extends essentially along said main direction.

[0039] The end view in Fig. 2 shows the shape of the traveller 3 in greater detail, whereby is understood that the fastener 4 is arranged sideways of a space 17 for receiving the safety rail 2 and in particular in line with a main plane H through this space 7 and a received safety rail. This is seen in a direction R at a right angle to the main plane H.

[0040] The space 17 exhibits an opening 19 for the passage of fastening elements such as screws that are used for fastening the safety rail 2 to a structure, a ladder, a set of brackets etc.

[0041] An extension 20 of the space 17 allows passage of screw heads, nuts or the like of said fastening elements.

[0042] Fig. 3 illustrates diagrammatically an arrangement of an inventive system on a building structure. A wall ladder 21 and a roof ladder 22 have each one being provided with elongated safety rails 2 placed at the sides and connected to each other. From the roof ladder 22 also extends an essentially horizontally adjoining safety rail 2 which here is fastened to a roof bridge 23 from the roof ladder 22 to a chimney on the building.

[0043] Between the wall ladder 21, the roof ladder 22 and the roof bridge 23 there are suitably arranged soft rounded transitions allowing a traveller 3 to be displaceable between the safety rail on the wall ladder 21 the safety rail 2 on the roof ladder 22 and the safety rail 2 on the roof bridge 23.

[0044] Figs. 4a, b and c show a differently constructed traveller 3 in different positions. The cut-out 27 in the fastener 4 also here has an extension in parallel to a main direction of said space 17 (see Fig. 2). In particular, in this embodiment, the cut-out 27 is a slot having a first portion 28 being closest to the portion 18 for locking engagement and extending essentially crosswise to said main direction. A second portion 29 of the slot 27 forms an acute angle β with said main direction, said angle being open opposite to the locking direction S. This second portion 29 of the slot 27 extends from the first portion 28 closest to the portion 18 for locking engagement to an opposite region of the traveller.

[0045] A catch device 30 in form of a spring loaded ball or the like in the fastener is arranged for co-operation with a groove-shaped recess (not shown), preferably in the form of a ring-shaped groove directed against the fastener 4 inside an element/a washer 25 belonging to the fastener means 24 for the safety line.

[0046] The catch device 30 is arranged to co-operate with said groove-shape recess for holding the fastening means 24 of the safety line at tension forces F in the safety line up to a predetermined level. This state is illustrated on Fig. 4a. An attachment point of the tension force F on the traveller is thereby such that a convenient movement on the safety rail is possible according to the above.

[0047] When the force F exceeds the predetermined level, co-operation between the catch device 30 and said recess in the element 25 will be released such that the fastening means 24 of the safety line and thereby the

point of action of the falling force will be displaced to the end of the second portion 29 of the slot 27. This is illustrated on Fig. 4c. Hereby is ensured that the traveller in case of a fall is caught on the hook element 7 even if the force F should be excessively outwardly directed instead of what can be expected, to be more or less in parallel with the safety rail.

[0048] A fall damper 26 is positioned between the safety line and the traveller 3. It is in principle comprised of a bent-together metal rod or metal strip with a pair of inserted thin metal bridges. The aim of the fall damper is to allow energy absorption in case of a hard pull in the safety line in case of a fall, whereby the metal bridges are broken and the metal rod/metal strip is straightened out in an energy absorbing process.

[0049] Fig. 5 shows a further alternatively constructed and simplified traveller compared to the traveller according to Figs. 4a - c. The fastener 4 is here provided with two holes, a first hole 31 and a second hole 32 for alternative permanent attachment of the fastening means of the safety line. The traveller 3 in Fig. 5 is adapted for right and left mounting, i.e. with a free side of the rail 2 (see the above) on the first or the second side of the user. In case of a vertical rail, typically the lower one of the holes 31 and 32 is used for the fastening means of the safety line. Experience after extensive testing shows that such fastening in the lower one of two fastening holes that are correctly positioned allows faultless function of the function according to the invention.

[0050] The invention can be modified within the scope of the following claims. The curve being described by the second longitudinal edge K2 is meandering and can have different shapes whereof shallow sinus shaped or otherwise shallow rounded is preferred because it is then easy to move the traveller along the safety rail.

[0051] The traveller can be permanently applied to the safety rail for use of a worker. The traveller can also be brought along by a worker for attachment on the safety rail for a working cycle.

[0052] The rail is preferably manufactured from a metal plate material, the traveller from an extrusion formed profile of aluminum or an aluminum alloy or of bent plate material in one piece, whereby the fastener is formed through milling, drilling, punching or the like.

Claims

1. Safety rail (2) included in a system for protecting a person from fatal falls from a structure, wherein the safety rail (2) is elongated and generally strip shaped and arranged for fastening along passage (21,22,23) on the structure, wherein the safety rail (2) comprises a first and a second longitudinal edge (K1,K2), wherein the safety rail (2) is arranged for co-operation with a moveable traveller (3) having a fastener (4) for co-operation with the safety line being connected to said person, and wherein the safety rail (2) exhibits means for locking the traveller (3) in a locking direction (S), **characterized in**

   - **that** the first longitudinal edge (K1) exhibits a plurality of hook elements (7) each one with a hook surface (8) directed essentially opposite to the locking direction (S) for locking engagement with a portion (18) of the traveller (3),
   - **that** the second longitudinal edge (K2) extends with a stretched-out meander shape with alternating inward bends (6) and outward protrusions (5),
   - **that** each inward bend (6) and each hook element (7) are positioned opposite to each other, and
   - **that** each outward protrusion (5) is positioned opposite to a portion (10) between two hook elements (7).

2. Safety rail according to claim 1, **characterized** in

   - that the second longitudinal edge (K2) extends shallow sinus-shaped or shallow zigzag-shaped or in a meander curve form described by circular arc portions or in a combination of these alternatives.

3. Safety rail according to claim 1 or 2, **characterized** in

   - that the hook surface (8) forms an open angle (α) opposite to the locking direction (S) to an extension direction (U) of the safety rail (2).

4. Safety rail according to claim 3, **characterized in that** said angle (α) is an acute angle and preferably between 60° and 90°.

5. Safety rail according to any one of the previous claims, **characterized** in

   - that the safety rail (2) exhibits means (9) for attachment thereof on a roof ladder, a building wall, a mast or a bracket arrangement.

6. Traveller (3) included in a system for protecting a person from fatal falls from a structure, wherein the traveller exhibits a fastener (4) for co-operation with a safety line being connected to the person, wherein the traveller (3) is arranged to be moveable along a safety rail (2) according to any one of the claims 1 - 5, being arranged along a passage (21,22,23) on the structure, and wherein the traveller (3) is arranged to be locked in a locking direction (S) on the safety rail (2), **characterized in**

   - **that** the fastener (4) is arranged on a portion of the traveller being positioned sideways of and

essentially in line with an main plane (H) through a space (17) for form-fitting reception of the safety rail (2), and

- **that** the traveller (3) exhibits a portion (18) for locking engagement with hook elements (7) being arranged on a first longitudinal edge (K1) of the safety rail (2).

7. Traveller according to claim 6, **characterized in**

- **that** the traveller (3) along its length is provided with an opening (19) to said space (17) for passage of fastening means during movement of the traveller (3) along the safety rail (2).

8. Traveller according to claim 7, **characterized in**

- **that** the traveller (3) exhibits an extension (20) of said space (17) opposite to said opening (19).

9. Traveller according to any one of the claims 6 - 8, **characterized in**

- **that** the fastener (4) has a cut-out with an extension in a direction in parallel with a main direction of said space (17) for allowing that a fastening means (24) of the safety line is moveably received in respect of said main direction of the traveller.

10. Traveller according to claim 9, **characterized in**

- **that** the cut-out is a slot whereof a first portion, being closest to said portion (18) for locking engagement, extends essentially crosswise to said main direction, and whereof a second portion forms an acute angle with said main direction, wherein a catch means for holding the fastening means (24) of the safety line at tension forces up to a predetermined level is arranged in the region of the first portion.

11. Traveller according to claim 9, **characterized in**

- **that** the cut-out is limited by a loop portion, which extends essentially along said main direction.

12. Traveller according to any one of the claims 6 - 11, **c h a r a c t e r i z e d** in

- that the traveller (3) carries an energy absorbing fall damper arranged between the traveller and the safety line.

13. System for protecting a person from fatal falls from a structure including at least one safety rail (2) according to any one of the claims 1- 5 and at least one traveller (3) according to any one of the claims 6 - 12.

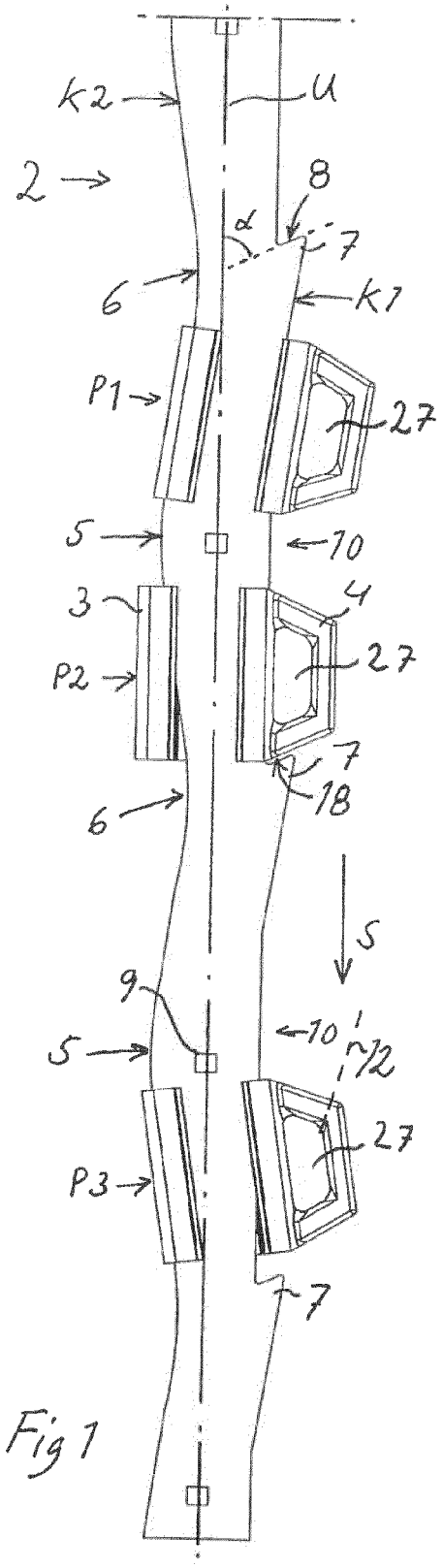


Fig 1

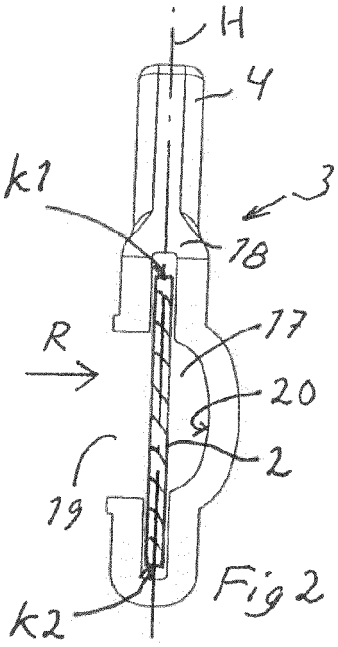


Fig 2

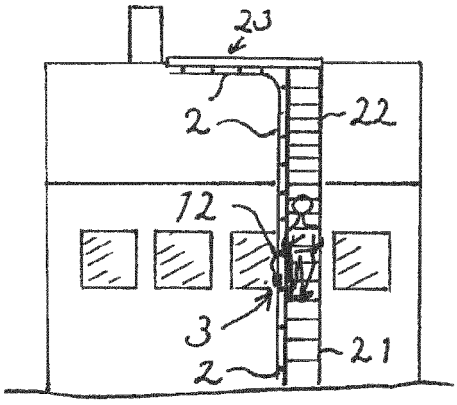


Fig 3

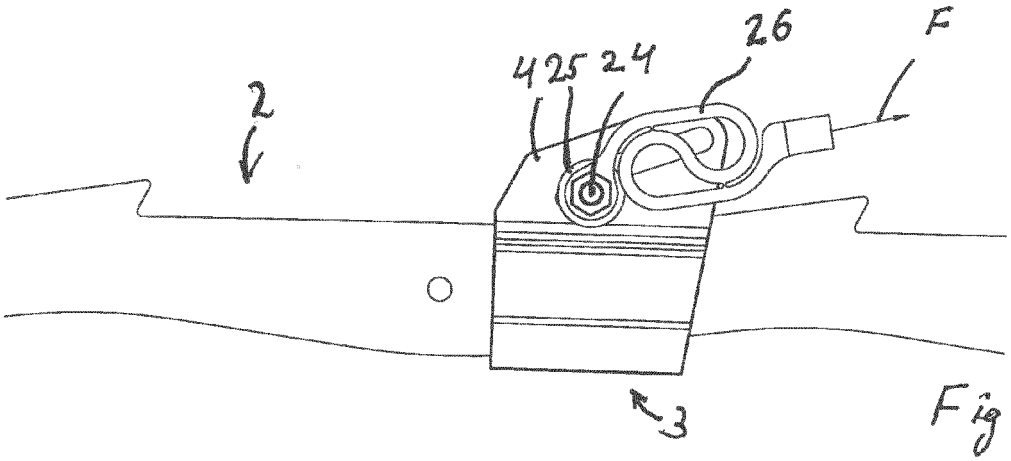


Fig 4a

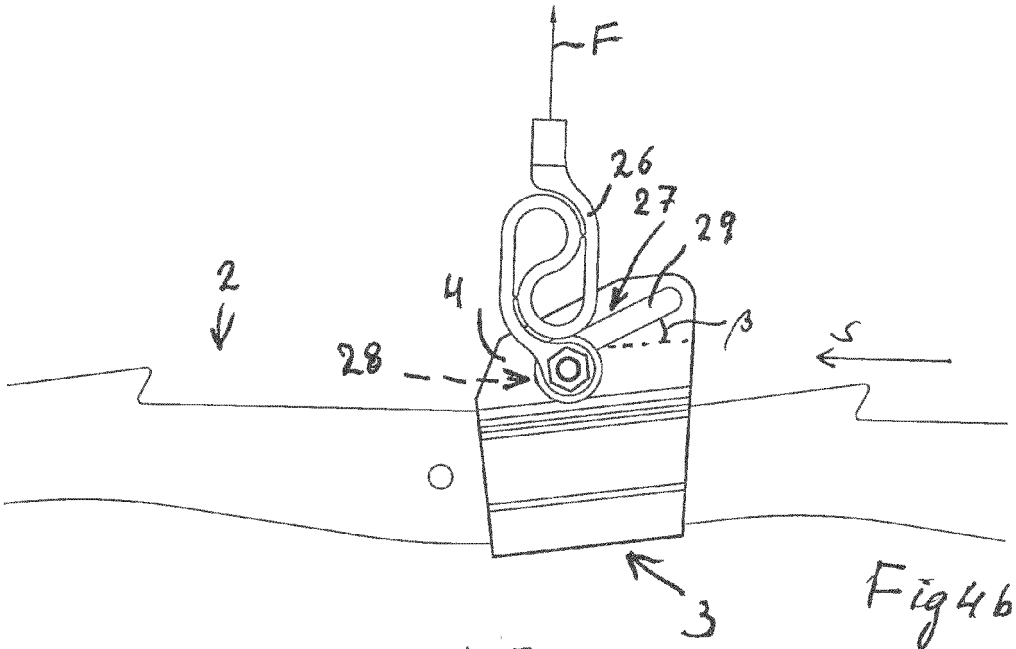


Fig 4b

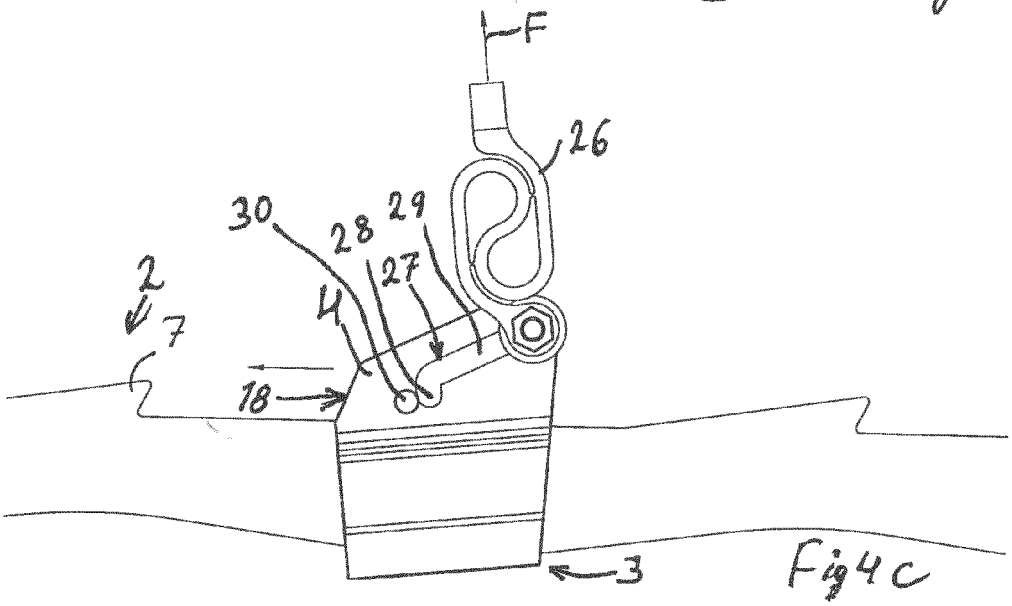


Fig 4c

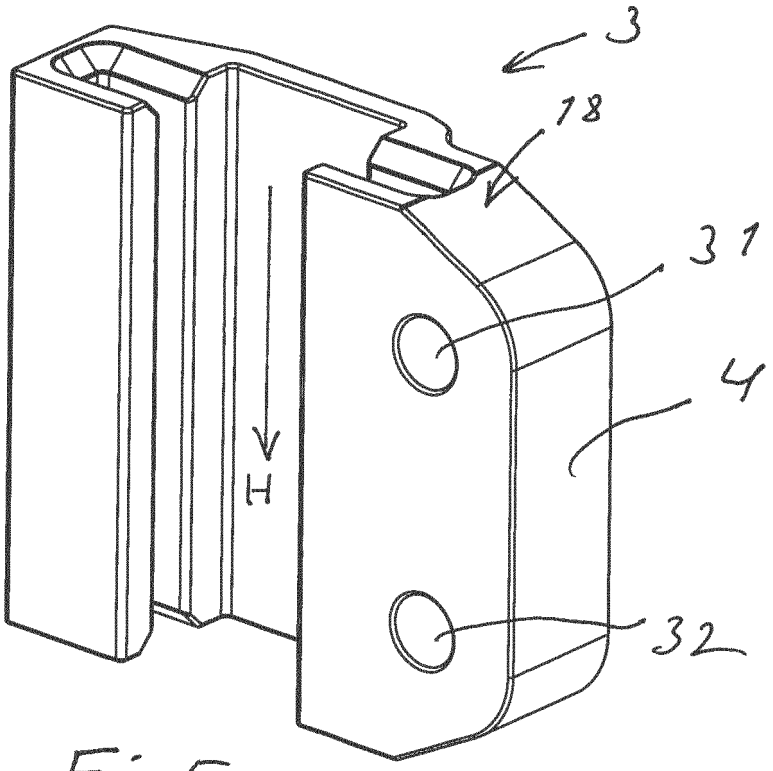


Fig 5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 15 17 0456

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 20 2009 005417 U1 (J & W REINIGUNGSSYSTEME GMBH [DE]) 18 June 2009 (2009-06-18) * paragraph [0201] - paragraph [0219]; figures 20,25,31,32 *	1-13	INV. E04G21/32 A62B35/00 E06C7/18
A	DE 346 514 C (BRUNO BRAUER) 23 December 1921 (1921-12-23) * figure 1 *	1-5	
A	DE 10 2012 018762 A1 (GUENZBURGER STEIGTECHNIK MUNK GMBH [DE]) 27 March 2014 (2014-03-27) * figure 1 *	1-5	
A	JP S48 35723 U (NAYODAKUKUWO) 28 April 1973 (1973-04-28) * figure 2 *	1-5	
A	US 1 373 133 A (HUFF EDWARD I) 29 March 1921 (1921-03-29) * figure 4 *	1-5	
X	US 2010/294590 A1 (BODNAR JONATHAN [US] ET AL) 25 November 2010 (2010-11-25)	6-12	TECHNICAL FIELDS SEARCHED (IPC) E04G A62B E06C
A	* figure 6 *	1-5,13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 September 2015	Baumgärtel, Tim

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)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 17 0456

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-09-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 202009005417 U1	18-06-2009	DE 102009011884 A1	21-01-2010
		DE 202009005417 U1	18-06-2009
DE 346514 C	23-12-1921	NONE	
DE 102012018762 A1	27-03-2014	NONE	
JP S4835723 U	28-04-1973	JP S4835723 U	28-04-1973
		JP S5138197 Y2	18-09-1976
US 1373133 A	29-03-1921	NONE	
US 2010294590 A1	25-11-2010	AU 2010249942 A1	08-09-2011
		CN 102596327 A	18-07-2012
		EP 2432563 A1	28-03-2012
		US 2010294590 A1	25-11-2010
		WO 2010135088 A1	25-11-2010

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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 20100012426 A1 **[0004]**
- US 4269284 A **[0004]**