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(72) Inventors:
• **Golkowski, Mariusz**
30-079 Kraków (PL)
• **Budnicki, Marek**
31-135 Kraków (PL)
• **Biela, Tomasz**
43-340 Kozy (PL)

(74) Representative: **Górska, Anna**
Kancelaria Patentowa Anna Gorska
ul. Długa 59/5
31-147 Krakow (PL)

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(71) Applicant: **CBR ROCK MASTER spółka z
ograniczoną
odpowiedzialnością spółka komandytowa**
30-079 Kraków (PL)

(54) **A FIXED SYSTEM FOR PROTECTION AGAINST FALLS FROM HEIGHT**

(57) The object of the invention is a fixed system for protection against falls from height, comprising a steel rope of a horizontal system positioned substantially parallel to the roof surface characterised in that it comprises a steel rope of a vertical system, whose upper segment

is fixedly connected to one of the posts of the horizontal system, the steel rope of the horizontal system being fixedly situated above the roof level by means of at least two posts of the horizontal system.

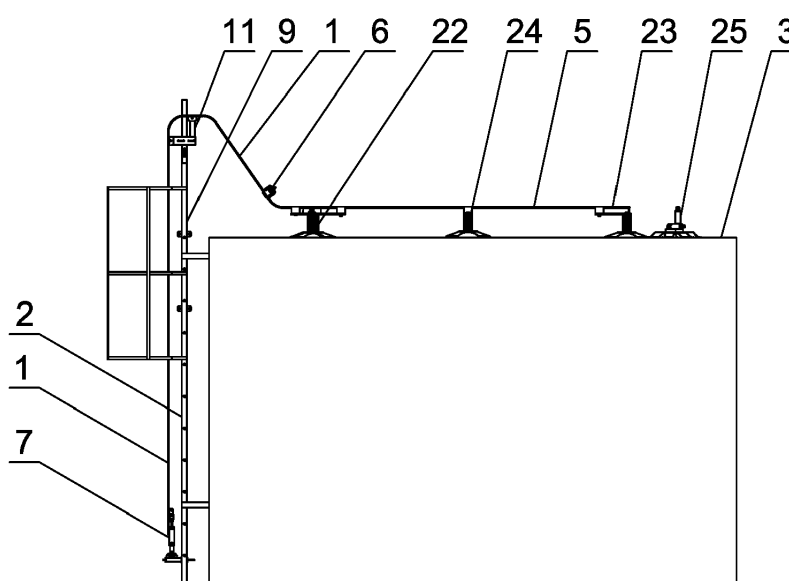


Fig.1

Description

[0001] The object of the invention is a fixed system for protection against falls from height, in particular from roofs of buildings, providing continuity of securement while entering and while staying on a roof.

[0002] The performance of work on flat roofs is associated with a serious risk of falling both when entering and staying on a roof. There are known systems of vertical securement for people climbing a ladder. However, there is a general lack of the ability to provide continuous protection when moving from the edge of the roof to its surface. It is assumed that the hazardous zone extends approximately 1.8 m from the roof edge, and its crossing can result in a fatal fall. All construction, servicing and snow removal work performed on the roofs of buildings in the hazardous zone is potentially extremely dangerous to health and life; therefore, its performance without collective or individual protection is unacceptable. Additionally, on the roof surface there can be elements posing a risk of falling through the roofing, such as skylights, roof windows, glass walls. Staying in their vicinity also requires protection.

[0003] The risk of falling from the edge of a building roof is currently eliminated by mounting protective barriers or safety nets. Such temporary or fixed individual protections are mounted on the roofs of buildings, placed in individual anchoring points mounted especially for this purpose. They are also meant for securement during the performance of work at heights related to washing the facades of buildings, especially glass ones.

[0004] So far, the most efficient protection against falls from height for a person working on a roof involved the assembly of protective barriers on its edge. However, the solution - readily used during construction work - is not popular as a fixed protection, e.g. due to high costs of such an investment; therefore, a popular method for fixedly protecting a roof involves the installation of the safety system in the form of a combination of steel ropes or rails. Such a solution is advantageous for the people assembling such systems because they are relatively far away from the edge of the roof, and subsequently, having such a system at their disposal, they can safely perform further actions in a falling hazardous area.

[0005] From British patent description of invention no. GB 2 393 206 B there is a known horizontal system protecting against falls, comprising a rigid protective rail, to which at least one carriage is mounted, connected via a safety rope to a safety harness. The protective rail is provided with counterbalances lying on the roof of the building.

[0006] From European application description no. EP 1 818 480 A2 there is in turn known another horizontal securement system, consisting of numerous elements, intended for use on the roofs, provided with a main guide placed parallel to the roof surface, at a certain distance from its edge, which enables the user to safely reach the edge of the roof as well as to reach its corners.

[0007] There is also a horizontal system preventing people from falling off the roof, known from Dutch patent description no. NL 2 007 963 C, which comprises an arrangement of substantially parallel rails placed on the roof at a certain distance from its edge, to which securement ropes are attached. The securement ropes are attached to rails by means of devices moving thereon, allowing the movement of people connected by ropes to rails and their safe performance of work on the edge of the roof with no risk of falling.

[0008] From another European patent application no. EP 2 606 939 A2 there is a known system, securement rope and method preventing people from falling off the corners of the roofs, which comprises a special harness and a securement rope meant to fasten a person working in a corner of a roof simultaneously and directly to two anchors mounted on the roof surface. Additionally, from European patent application EP 2 712 982 A1 there is a known horizontal system protecting and preventing falls from the roofs placed along their edges, but at a certain distance from them, to which securement ropes are attached, used to fasten people working at heights to them. This system consists of a set of concrete weights placed on the roof, connected to each other by means of pipes or rods, on which the guides of securement ropes are mounted.

[0009] None of the abovementioned fixed horizontal systems solve the problem of the connection to fix vertical systems. Known fixed systems do not protect people who enter the roof via the external ladder located along the wall of a building, or those who enter the roof via hatches placed in the roof slope. Moving along a several-metre segment from the end of the ladder at the edge of a roof or the edge of a hatch to the horizontal rope system fixedly positioned on the roof of the building proceeds without protection - this is the so-called lack of continuity of securement, which is a cause of numerous fatal accidents. The risk of an accident is considerably increased in the winter and it is augmented by rain, snow or low temperature - the roof surfaces are particularly dangerous then. Sometimes, in order to limit the risk of falling, an additional anchoring intermediate post is fixedly placed at a certain distance from the edge of a roof or a hatch. However, this requires the user to use a double, quite long safety rope, and perform a number of complicated, non-standard actions, which is not without impact on his safety. It is therefore desired to fixedly connect the elements of vertical (protecting a person climbing a ladder or exiting a hatch) and horizontal securement (placed fixedly on a roof slope) into one integrated fixed system whose use does not additionally require the user to perform complicated actions, in particular near the edge of a roof or a hatch.

[0010] A solution to a number of previously existing problems can be provided by the use of a fixed system according to the invention. The object of the invention is to prepare a new fixed system allowing safe performance of work at heights.

[0011] A fixed system for protection against falls from height according to the invention comprises a steel rope of a horizontal system, positioned substantially parallel to the roof surface, and a steel rope of a vertical system, whose upper segment is fixedly connected to one of the posts of the horizontal system, the steel rope of the horizontal system being fixedly situated above the roof level by means of at least two posts of the horizontal system.

[0012] Preferably, the posts of the horizontal system are a turntable, a corner post, an intermediate post, a free-standing post or a tensioner post.

[0013] Preferably, the turntable comprises a turntable crown, provided with a guide with a circular tube, in which there are in fixed position: the end of the steel rope of the vertical system and at least two guides with the circular tubing, in which there are fixed in position the ends of at least two segments of the steel rope of the horizontal system, as well as a rotary plate with a central guide with a circular tube situated thereon.

[0014] Preferably, the steel ropes are separably connected to a self-gripping device.

[0015] Preferably, the self-gripping device is connected to a safety rope or a self-clamping device.

[0016] Preferably, the steel rope of the vertical system is partially placed along a ladder leading onto a roof.

[0017] Preferably, the steel rope of the vertical system is provided with a longeron, preferably made of a U-shaped profile.

[0018] Preferably, the steel rope of the vertical system is anchored in the upper part of the ladder (or in the upper part of the longeron) by means of an upper anchoring device, with a shape resembling the letter L, preferably made of two steel profiles connected to each other at an angle α of substantially 90° , on whose radii guides provided with two circular tubing are placed.

[0019] Preferably, the steel rope of the vertical system is anchored directly in the wall of a building, by means of a guide provided with circular tubing.

[0020] Preferably, the steel ropes of the vertical and horizontal system can be provided with a connection assembly, which comprises a plug provided with a mandrel, a guide with a circular tubing. Here the end of one segment of the steel rope is fixed in position, and a plug socket placed in the mounting element, along with a guide with a circular tubing, in which the end of another segment of the steel rope is fixed in position.

[0021] Preferably, the system according to the invention comprises of a junction, where at least one edge is provided with an arch-shaped through the circular tubing.

[0022] Preferably, the system according to the invention comprises a free-standing post provided with a rotary hinge provided with a cylindrical bushing and a mandrel, connected to each other by means of a pin.

[0023] The solution according to the invention is presented in the attached drawing, where: fig. 1 presents the system according to the invention, comprising a rope of the vertical system **1** and a ladder **2** provided with a longeron **9** (in an embodiment comprising a ladder **2** lead-

ing onto the roof **3** along an outer wall of a building); fig. 2 presents the system according to the invention in a general top view (in an embodiment comprising a ladder **2** leading onto the roof **3** along an outer wall of a building); fig. 3 presents a steel rope of the vertical system **1** loaded with a weight **8**, provided with a connection assembly **15**, extending along a ladder **2** leading onto the roof **3** inside a building, and subsequently above the roof surface **2**, maintained by the intermediate post **24** and fixedly attached to the turntable **22**; fig. 4 presents the turntable **22** in a general top and side view; fig. 5 presents the corner post **23** in a general top and side view; fig. 6 presents the intermediate post **24** in a general top and side view, in another embodiment; fig. 8 presents the free-standing post in a cross-section **25**; fig. 9 presents the tensioner post **26** in a general top and side view; fig. 10 presents the shock absorber-strainer **28** in a cross-section; fig. 11 presents the self-gripping device **6** in a side view; fig. 12 presents the longeron **9** in a general side view; fig. 13 presents the upper anchoring device **11**; fig. 14 presents the connection assembly **15** in a side view; fig. 15 presents a plug **16** of the connection assembly **15**; fig. 16 presents the mounting element **19** along with a visible socket **17** of the connection assembly **15**, provided with a guide **13** of the steel rope of the horizontal and vertical system **1**, which can be also mounted directly to the wall of the building; fig. 17 presents a two-way junction **33** in a general top view; fig. 18 presents a three-way junction **34** in a general top view.

[0024] The solution according to the invention, and as - in embodiments - presented in the attached drawing, comprises:

- a steel rope of the vertical system **1**, constituting an element of a fixed vertical securement system, placed substantially along a ladder **2** leading onto the roof **3** and - after reaching its edge **4** - over its surface, whose upper segment is fixedly connected to one of the posts of the horizontal system **22**, **23**, **24**, **25** or **26**,
- a steel rope of the horizontal system **5**, constituting an element of a fixed horizontal securement system, placed substantially parallel to the roof surface **3**, at a certain distance from its edge **4**, by means of at least two posts of the horizontal system **22**, **23**, **24**, **25** or **26**.

[0025] The self-gripping device **6**, which reversibly connects to the steel ropes of the vertical **1** or horizontal **5** system, is an element of the system used for connection with the user. The self-gripping device **6** can be removed from the steel rope **1** or **5** on any of their segments. The self-gripping device **6** is connected to a known safety rope or a known self-clamping device.

[0026] The vertical fixed securement system, constituting a part of the system according to the invention, comprises a steel rope of the vertical system **1** placed

substantially along the ladder **2** leading onto the roof **3** and - after reaching its edge **4** - above its surface. Preferably, the steel rope of the vertical system **1** is anchored in the lower part of the ladder **2** by means of a lower anchoring device **7**, connected to the ladder **2** by means of bolts. The lower anchoring device **7** is preferably provided with a spring compensating for the stresses of the steel rope of the vertical system **1**, resulting, e.g. from variable atmospheric conditions, and simultaneously providing its fixed tension. In one embodiment of the invention, as presented in fig. 3, the steel rope of the vertical system **1** hangs freely along the ladder **2**, loaded at the bottom with a weight **8** whose mass is no smaller than 1 kg. This embodiment of the system according to the invention is intended for mounting in buildings, in which access to the roof **2** is provided by a roof hatch, with, e.g. a portable or fixedly mounted ladder **2** leading to it.

[0027] The steel rope of the vertical system **1** is placed substantially along the ladder leading onto the roof **3** and - after reaching its edge **4** - above its surface. The upper segment of the steel rope of the vertical system **1** is fixedly connected to one of the posts of the horizontal system **22, 23, 24, 25** or **26**.

[0028] The ladder **2**, along which the steel rope of the vertical system **1** is guided, can be provided with a longeron **9**, preferably made of a steel U-shaped profile. The longeron **9** is mounted to the ladder **2** by means of mounting sheets **10** and bolts.

[0029] In one of the embodiments of the system according to the invention, the steel rope of the vertical system **1** is anchored in the upper part of the ladder **2** or in the upper part of the longeron **9** by means of an upper anchoring device **11** with a shape of the letter L, preferably made of two steel profiles connected to each other at an angle α of substantially 90° by means of bolts. On the arms **12** of the upper anchoring device **11** there are placed guides **13** provided with circular tube **14**, through which the steel rope of the vertical system **1** is lead.

[0030] In another embodiment of the system according to the invention, intended in particular for use in buildings in which access to the roof **3** is provided by a roof hatch, the steel rope of the vertical system **1** is fixedly anchored in the wall building by means of a guide **13** provided with a circular tube **14**.

[0031] The steel ropes of both the vertical **1** and the horizontal system **5** can be provided with a connection assembly **15**, comprising a plug **16** and a plug socket **17**. The use of the plug **16** of the connection assembly **15** allows dividing the steel rope **1** or **5** into segments and their safe separation, e.g. in order to close the roof hatch, door or window. The main element of the plug **16** is the plug mandrel **18**, which - in order to connect two segments of the rope **1** or **5** - is placed in the plug socket **17** situated in the mounting element **19** situated, e.g. on the building wall (preferably on the bearing construction of the roof). The mounting element **19** is provided with a guide **13** with a circular tube **14** situated parallel to the direction of extension of the steel rope of the vertical **1**

or horizontal system **5**, in which an end of its one segment is fixedly positioned, preferably by crumpling. The plug **16** is provided with a guide **13**, also provided with a circular tubing **14**, in which there is a fixedly placed (preferably by crumpling) beginning of the next segment of the steel rope **1** or **5**. After placing the plug **16** in the plug socket **17**, the circular tubing **14** about each other, retaining the continuity of the securement system. The plug mandrel **18** should be provided with a cotter **20**, which secures the plug **16** against undesired slipping out of the plug socket **17**. Moreover, it is worth providing the plug mandrel **18** with a stop **21**, which is used to hold the plug **16** in its intended position.

[0032] Having opened the roof hatch, using the steel rope of the vertical system **1** provided with a plug **16**, a user of the system according to the invention reaches for the plug **16** and places it in the plug socket **17**, subsequently securing the plug **16** with the cotter **20**, upon which they enter the surface of the roof **3** and by walking along the steel rope of the vertical system **1** reaches the post of the horizontal system, e.g. a turntable **22**, in which the end of the steel rope of the vertical system **1** is fixedly placed.

[0033] The horizontal fixed securement system consists of the posts of the horizontal system **22, 23, 24, 25, 26** and the steel rope of the horizontal system **5** placed parallel to the roof surface **3**, at a certain distance from its edge **4**, preferably at a distance of 2 to 8 m. The posts of the horizontal system can be: a turntable **22**, a corner post **23**, an intermediate post **24**, a free-standing post **25**, as well as a tensioner post **26**.

[0034] The corner post **23** is an element of the system used to guide the steel rope of the horizontal system **5**. It is positioned in places in which it is required to change its guiding direction. The intermediate post **24** is an additional element of the system according to the invention, used to retain the steel rope of the horizontal system **5** at a proper distance from the roof surface **3**. As a rule, the steel rope of the horizontal system **5** passing through the circular tube **14** of the guide **13** of the intermediate post **24** is capable of moving axially, although the circular tube **14** can be crumpled around the steel rope of the horizontal system **5**. The tensioner post **26** is an element of the system according to the invention used to mount the shock absorber-strainer **28** of the steel rope of the horizontal system **5**. The tensioner post **26** is provided with a shock absorber-strainer **28** provided with a spring **29** and it is connected to it by means of a mounting element with a shape resembling the letter L. The shock absorber-strainer **28** is used to maintain constant tension of the steel rope of the horizontal system **5**, which can undergo changes depending on atmospheric conditions, and allowing - due to the built-in spring - shock absorption of the system user's fall.

[0035] The upper end of the steel rope of the vertical system **1** is mounted to the post of the horizontal system **22, 23, 24, 25** or **26**, this post preferably being a turntable **22**. The steel rope of the vertical system **1** and the steel

rope of the horizontal system **5** converge in the turntable **22**. Both steel ropes **1**, **5** are fixedly positioned in the circular tube **14** of the guides **13** constituting the elements of the turntable **22**. The turntable **22** enables the user to smoothly switch between the steel ropes **1**, **5** of the vertical and horizontal systems and change the direction of movement, with no need for the user to unfasten themselves from the system. The turntable **22** comprises the crown **30**, a rotary plate **31**, a guide **13** of the steel rope of the vertical system **1**, guides **13** of the steel rope of the horizontal system **13** and a central guide **32**. The turntable **22** can also be provided with an additional, concealed shock absorber. The upper tip of the steel rope of the vertical system **1** and the tips of the steel rope of the horizontal system **5** are fixedly attached to the respective guides **13**, e.g. by being crumpled in the circular tubing **14**. After introducing the self-gripping device **6** into the central guide **32**, the user rotates the rotary plate **31** until connecting to the tip of at least one circular tube **14** with no need to switch the self-gripping device **6** between the steel ropes **1** and **5**. Because the rotary plate **31** is provided with a concealed slide bearing, it is not necessary to apply great force in order to perform the rotation. The remaining part of the turntable **22**, including the crown of the turntable **30**, remains stationary when the rotation is being performed.

[0036] Junctions - a two-way junction **33** or a three-way junction **34** - can be an additional element of the system according to the invention, used to guide the steel rope of the horizontal system **5**. The edge of the two-way junction **33**, situated on the inner side, is provided with a circular tubing **37**, arch-shaped with an angle β no smaller than 90° , inside which the steel rope of the horizontal system **5** is placed (or to which it is mounted). The two-way junction **33** is provided with a mounting hole **36**, by means of which it can be mounted, e.g. to the post base **27** or to the longeron **9** of the ladder **2**, by means of bolts or additional fittings. The three-way junction **34** has in turn a shape resembling a triangle with at least two arch-shaped concave edges. Each edge of the three-way junction **34** is provided with a circular tubing **37**, inside which the steel rope of the horizontal system **5** is placed (or to which it is mounted). The central part of the three-way junction **34**, preferably made of sheet metal, ensures its proper rigidity and necessary strength. The mounting hole **38** situated in the central part of the three-way junction **34** is used for its mounting, e.g. on a post.

[0037] The free-standing post **25** is an additional element of the horizontal system used for additional securement of users of the system. The free-standing post **25** comprises a post base **27** and a rotary hinge placed therein, made of a cylindrical bushing **39** and a mandrel **41**, connected to each other by means of a pin **40**. Rotation of the hinge proceeds around the pin **40** and around its axis. Inclination of the hinge results in raising the mandrel **41** held in the post base **27** by means of a set of springs **42**.

[0038] In order to use the system according to the in-

vention, while climbing onto the roof **3** and performing activities thereon, users remain permanently connected to the steel ropes **1** or **5**. The self-gripping device **6** is an optimal element of user's equipment, used for connection to the steel ropes **1**, **5**. The self-gripping device **6** connects separably to the steel ropes of the vertical **1** and horizontal system **5** and it can be removed from the rope in any of its segments.

[0039] The solution according to the invention allows eliminating a number of problems previously emerging during working at heights, including risks related to the imperfection of already existing ones. In addition, the system according to the invention generally has a universal nature - it can be mounted on most of existing roofing, construction elements, ladders. This system can constitute supplementation of previously existing horizontal installations. It can be used on already existing ladders. The system according to the invention also enables increasing the number of people who can use it at the same time, i.e. simultaneously perform work on the given roof. This is a tangible benefit for an administrator or owner of a building. Limitation of the users' possibilities to make mistakes related to their lack of knowledge, unawareness or carelessness is an obvious advantage of the solution according to the invention. Very important is that using the system is so easy that it eliminates difficulties related to its operation. This is important since the performance of work at heights causes stress by its very nature, which increases the risk of making a mistake. People who perform work on a roof sporadically are particularly subject to making mistakes.

Claims

1. A fixed system for protection against falls from height, comprising a steel rope of a horizontal system positioned substantially parallel to the roof surface **characterised in that** it comprises a steel rope of a vertical system (1), whose upper segment is fixedly connected to one of the posts of the horizontal system (22, 23, 24, 25 or 26), the steel rope of the horizontal system (5) being fixedly situated above the roof level (3) by means of at least two posts of the horizontal system (22, 23, 24, 25, 26).
2. The system according to claim 1, **characterised in that** the posts of the horizontal system are preferably a turntable (22), a corner post (23), an intermediate post (24), a free-standing post (25) or a tensioner post (26).
3. The system according to claim 2, **characterised in that** the turntable (22) comprises a turntable crown (30) provided with a guide (13) with a circular tube (14), in which there are fixed in position: the end of the steel rope of the vertical system (1) and at least two guides (13) with circular tubing (14), in which

there are fixedly placed ends of at least two segments of the steel rope of the horizontal system (5), as well as a rotary plate (31) with a central guide (32) with a circular tube (14) situated thereon.

4. The system according to claim 1 **characterised in that** the steel ropes (1, 5) are separably connected to a self-gripping device (6). 5
5. The system according to claim 4, **characterised in that** the self-gripping device (6) is connected to a safety rope or a self-clamping device. 10
6. The system according to claim 1, **characterised in that** the steel rope of the vertical system (1) is partially placed along a ladder (2) leading onto a roof (3). 15
7. The system according to claim 6, **characterised in that** the steel rope of the vertical system (1) is provided with a longeron (9), preferably made of a U-shaped profile. 20
8. The system according to claim 6, **characterised in that** the steel rope of the vertical system (1) is anchored in the upper part of the ladder (2) by means of an upper anchoring device (11) with a shape resembling the letter L, preferably made of two steel profiles connected to each other at an angle α of substantially 90°, on whose radii (12) guides (13) provided with circular tube (14) are placed. 25 30
9. The system according to claim 7, **characterised in that** the steel rope of the vertical system (1) is anchored in the upper part of the longeron (9) by means of an upper anchoring device (11) with a shape resembling the letter L, preferably made of two steel profiles connected to each other at an angle α of 90°, on whose radii (12) guides (13) provided with circular tube (14) are placed. 35 40
10. The system according to claim 1 or 7, **characterised in that** the steel rope of the vertical system (1) is anchored directly in the wall of a building by means of a guide (13) provided with circular tube (14). 45
11. The system according to claim 1, **characterised in that** the steel rope of the vertical system (1) is provided with a connection assembly (15). 50
12. The system according to claim 1, **characterised in that** the steel rope of the horizontal system (5) is provided with a connection assembly (15). 50
13. The system according to claim 11 or 12, **characterised in that** the connection assembly (15) comprises a plug (16) provided with a mandrel (18), a guide (13) and a circular tubing (14), in which the end of one segment of the steel rope (1, 5), is fixed in po-

sition, as well as a plug socket (17) positioned in the mounting element (19) provided with a guide (13) with a circular tube (14), in which the end of the next segment of the steel rope (1, 5) is in fixed position.

14. The system according to claim 1, **characterised in that** it comprises a junction (33, 34), whose at least one edge is provided with an arch-shaped circular tube (35, 37).
15. The system according to claim 1, **characterised in that** it comprises a free-standing post (25) provided with a rotary hinge provided with a cylindrical bushing (39) and a mandrel (41) connected to each other by means of a pin (40).

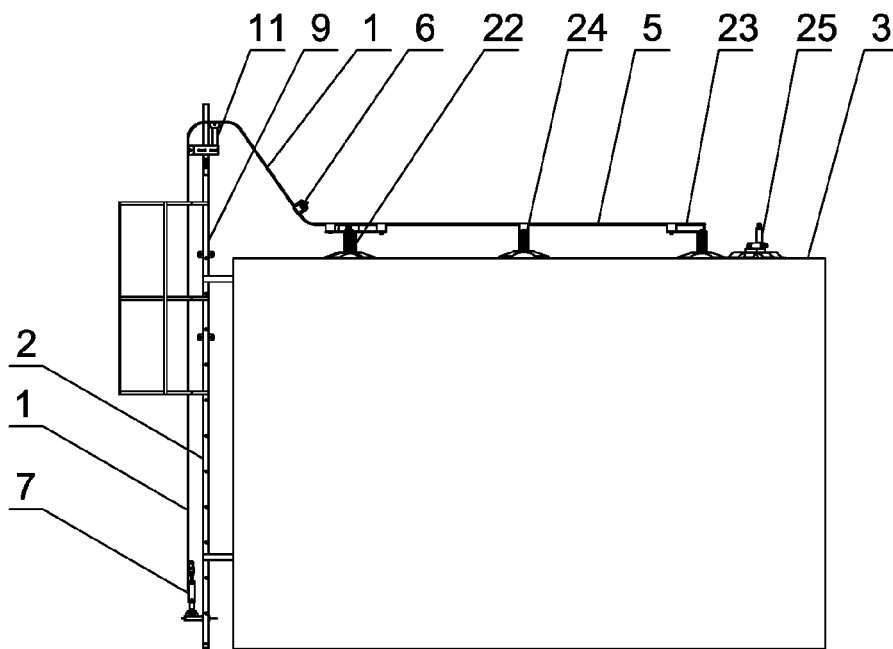


Fig.1

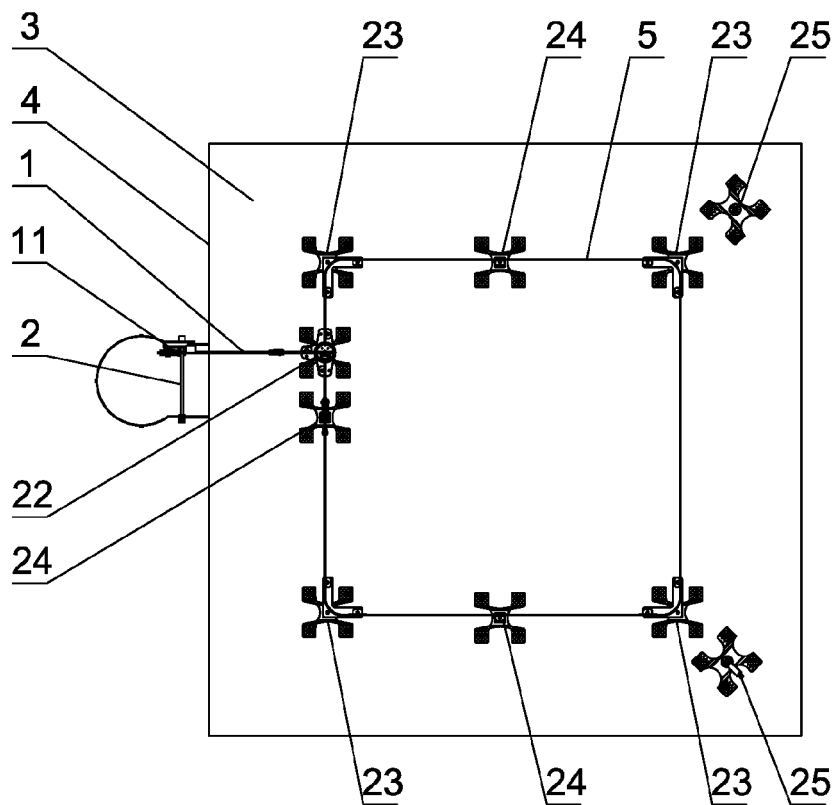


Fig.2

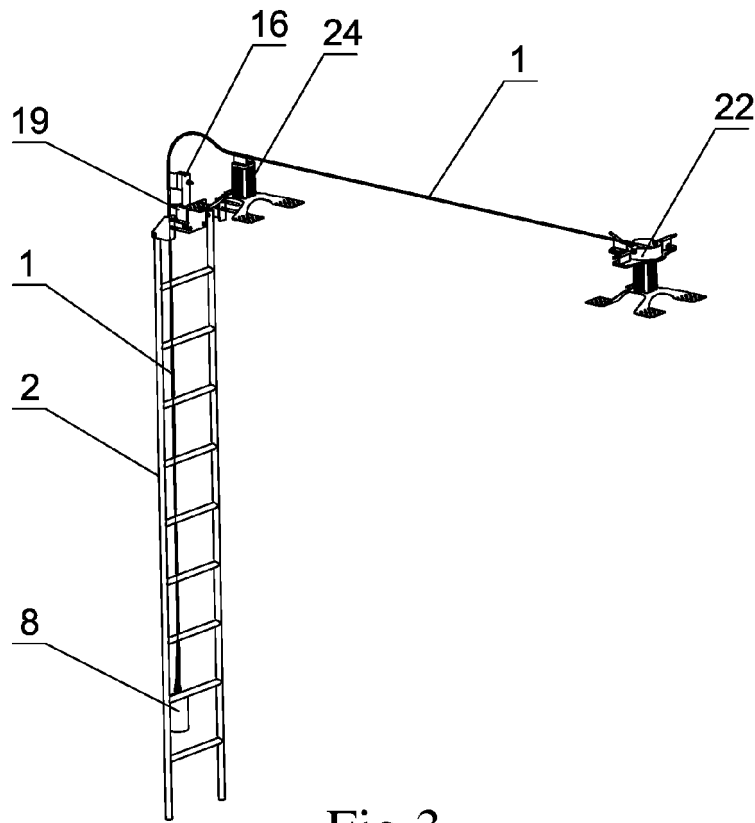


Fig.3

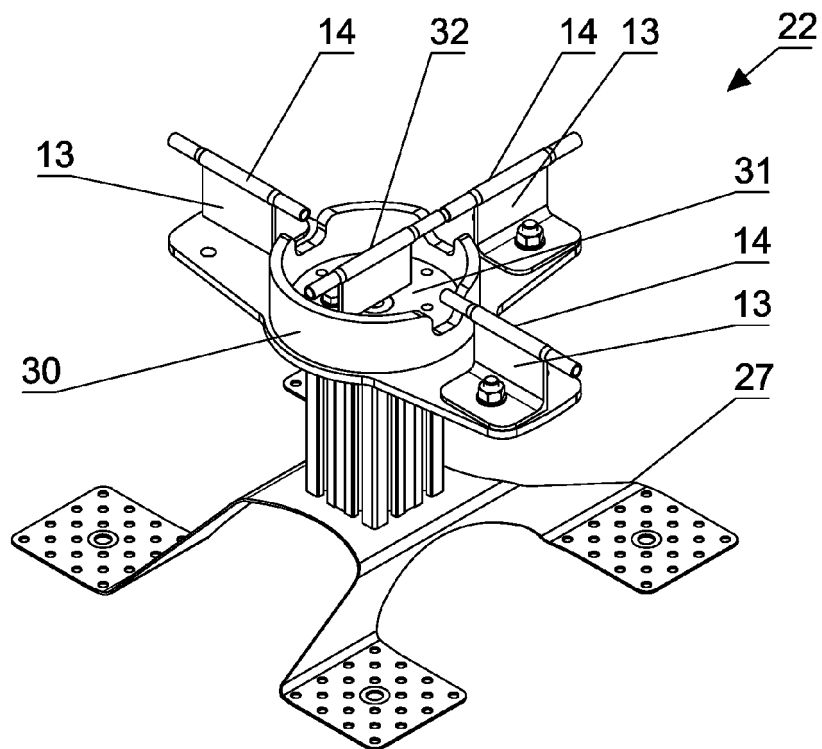


Fig.4

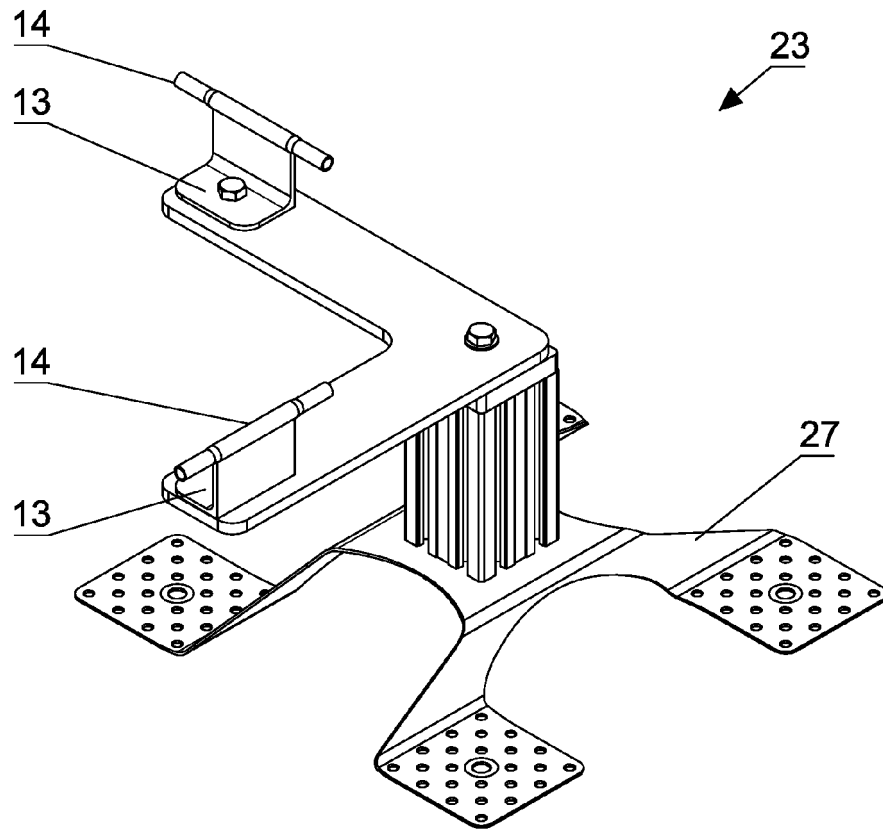


Fig.5

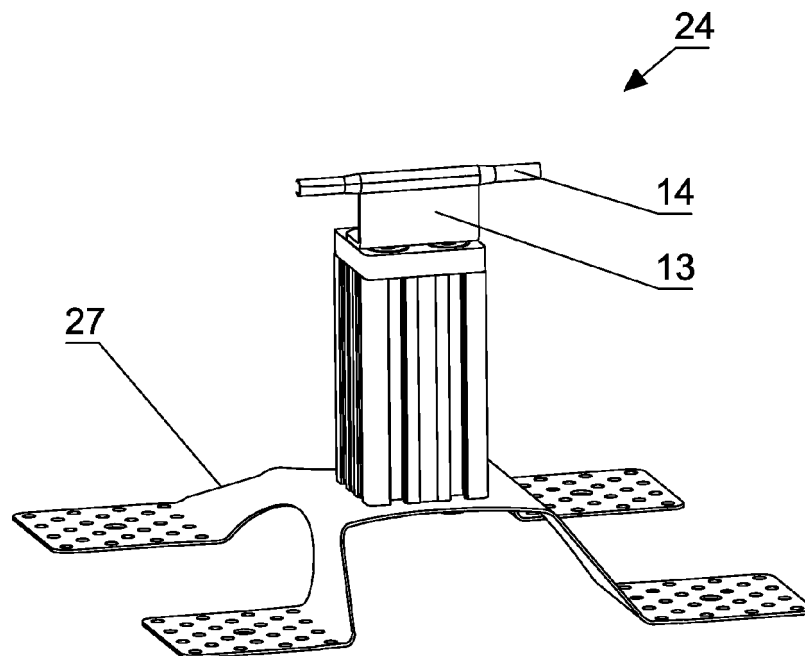


Fig.6

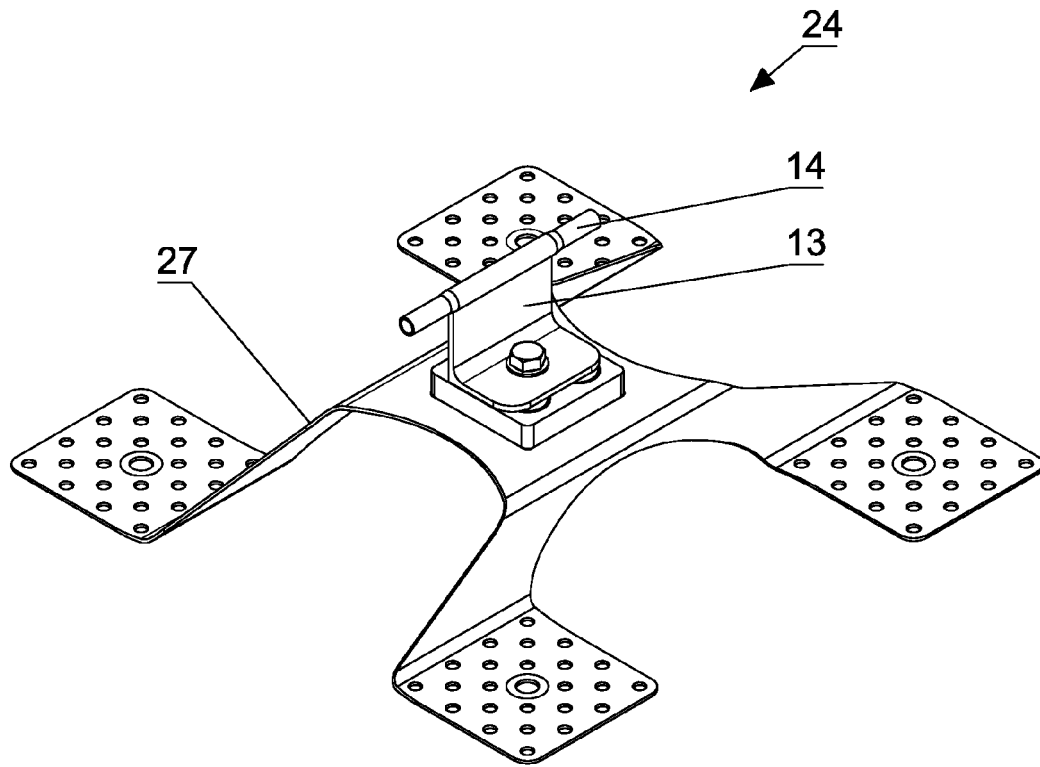


Fig.7

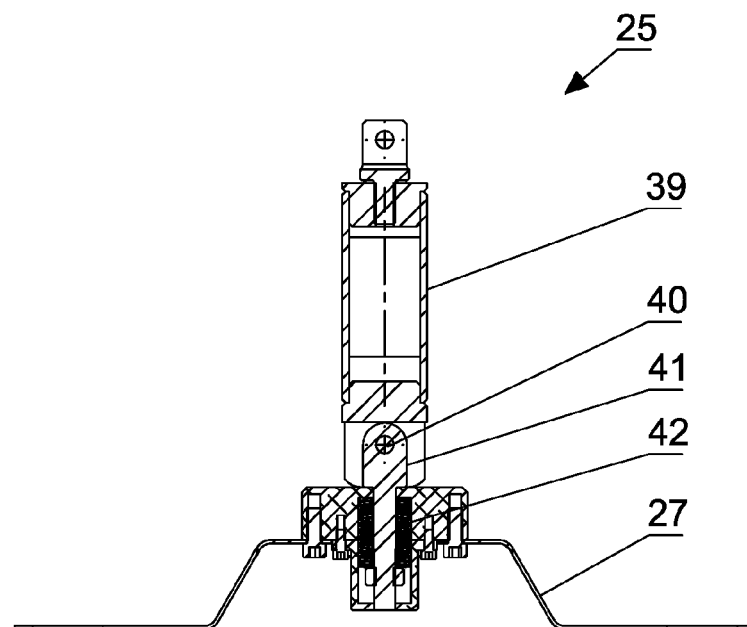


Fig.8

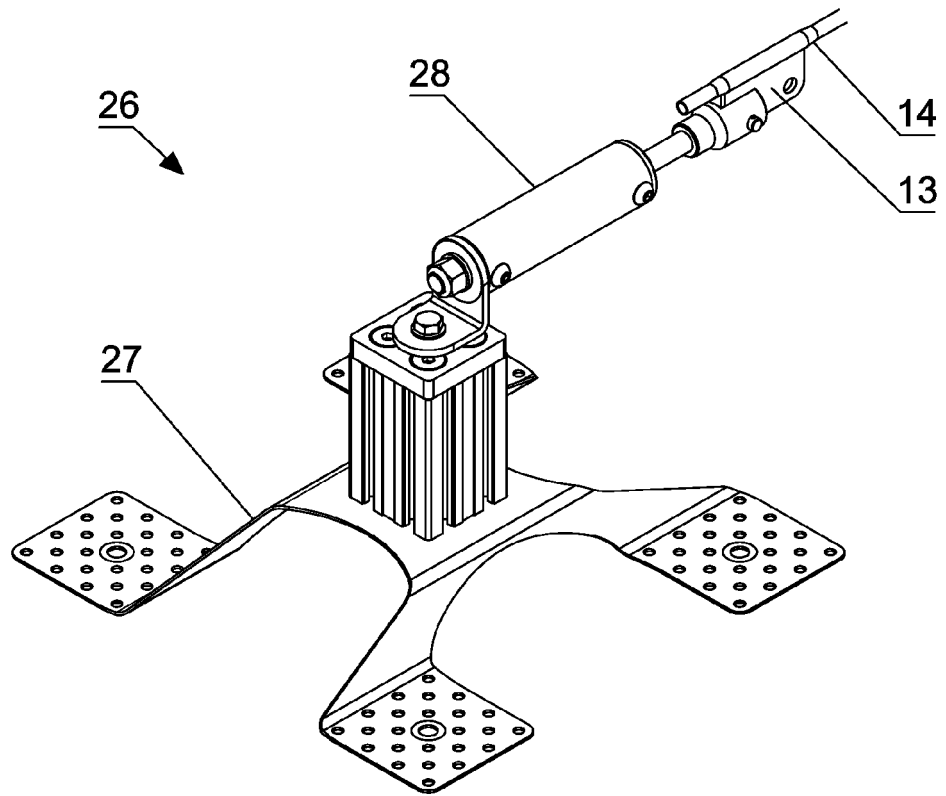


Fig.9

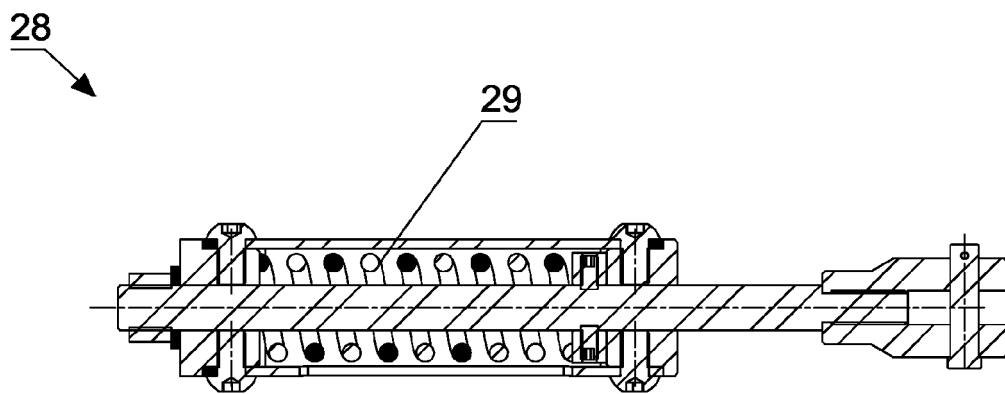


Fig.10

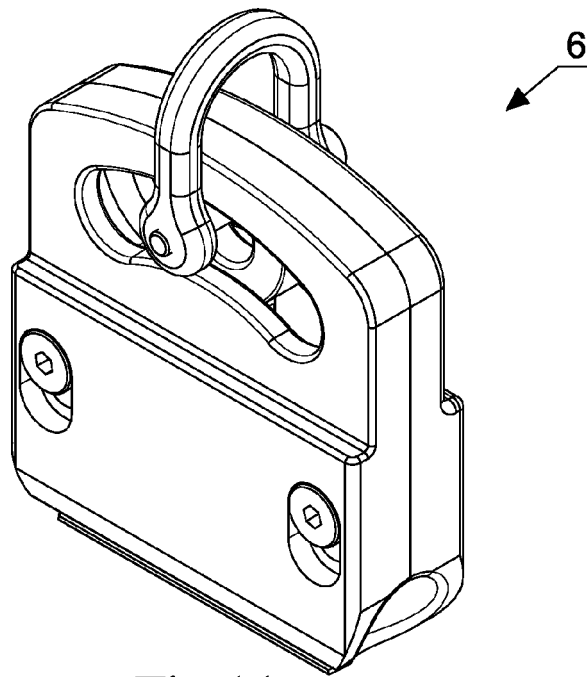


Fig.11

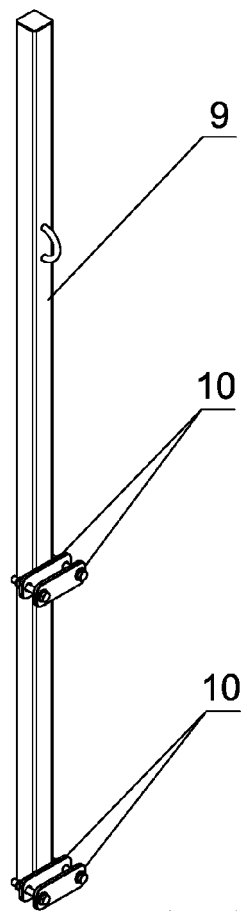


Fig.12

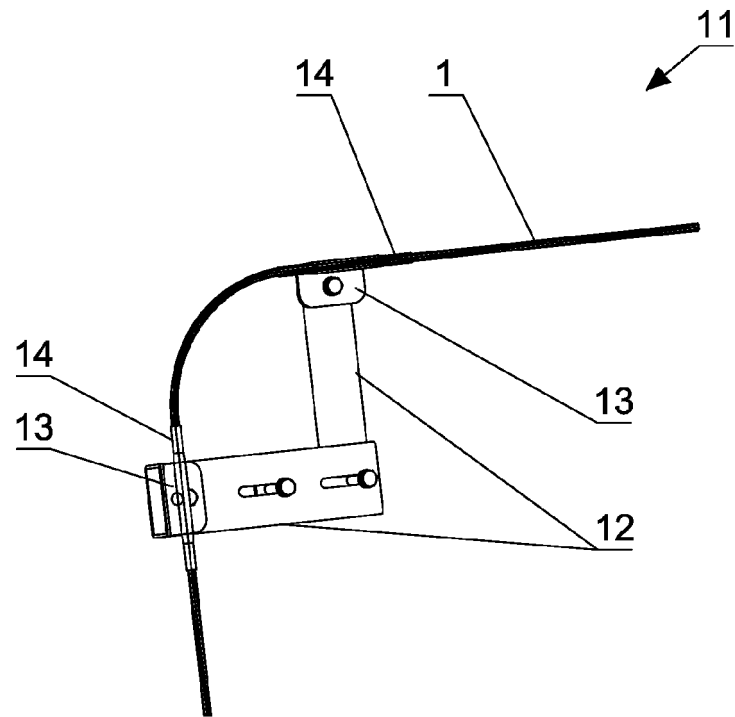


Fig.13

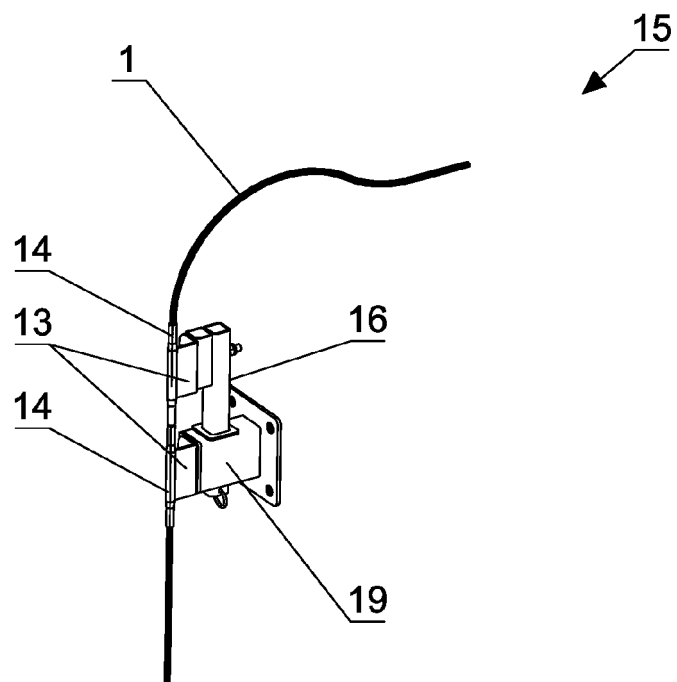


Fig.14

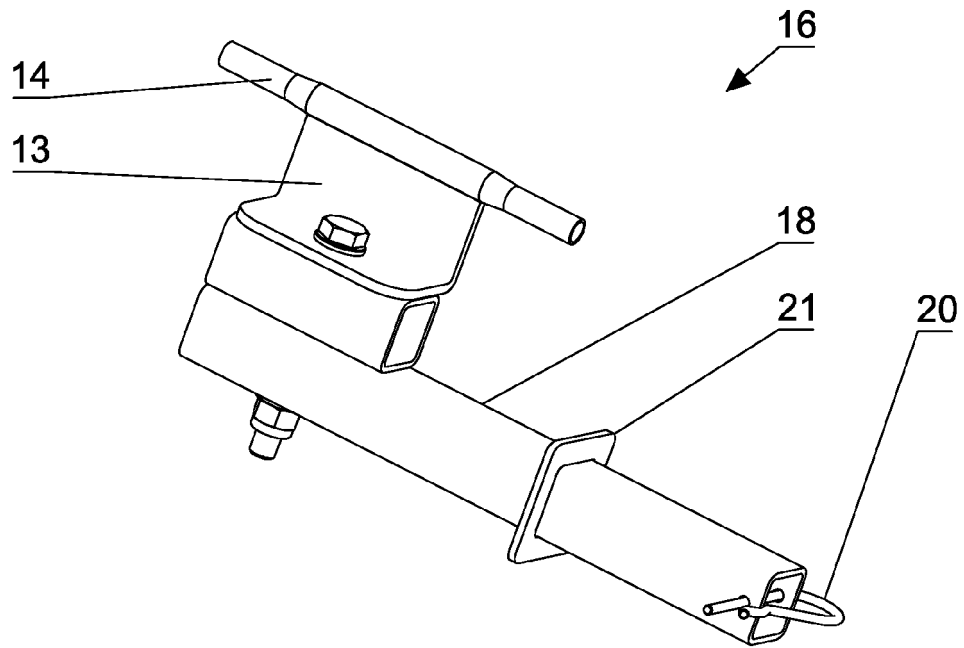


Fig.15

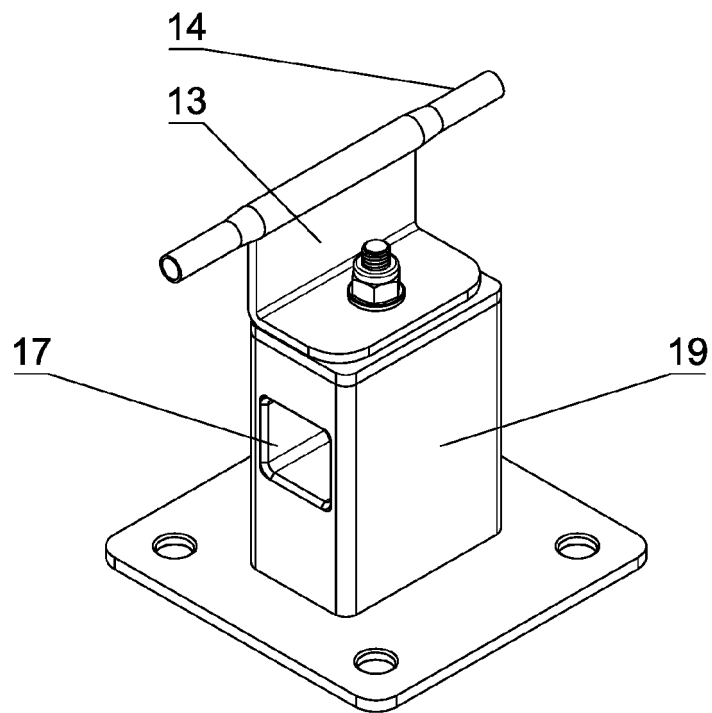


Fig.16

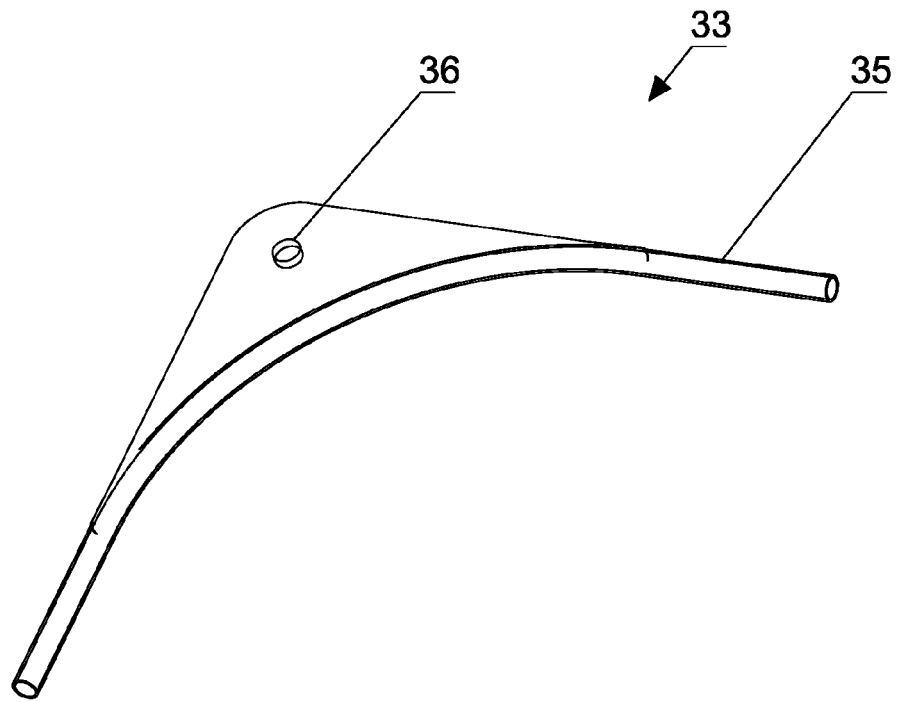


Fig.17

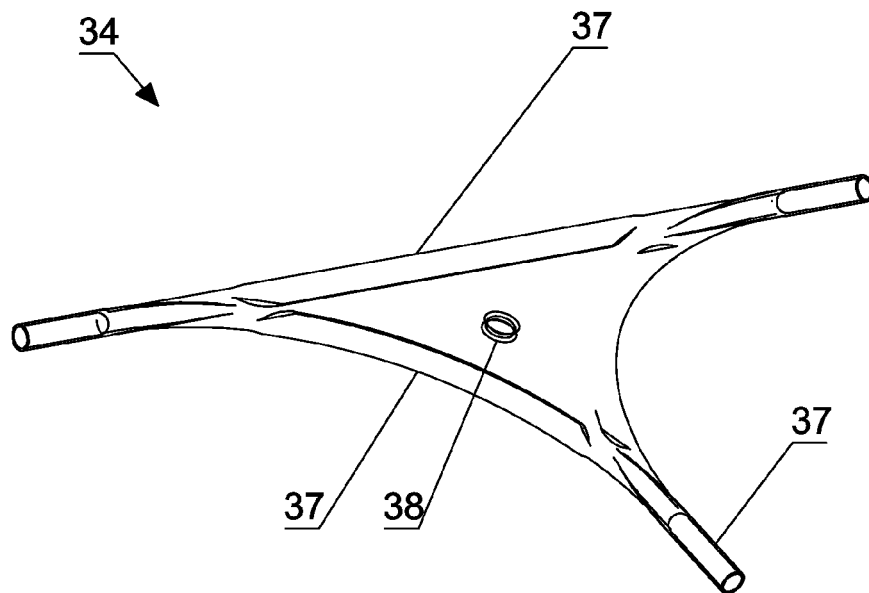


Fig.18



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Application Number
EP 19 19 1866

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	WO 2012/164278 A1 (CENTRAL HIGH RISE LTD [GB]; TURNEY KEITH [GB]; HOWGILL STEPHEN [GB]) 6 December 2012 (2012-12-06) * page 5, line 23 - page 6, line 23; figures 1-4 *	1-12,14, 15 13	INV. E04G21/32 E06C7/18 A62B35/00
			TECHNICAL FIELDS SEARCHED (IPC)
			E04G E06C A62C A62B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 March 2020	Examiner Baumgärtel, Tim
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p>			

EPO FORM 1503 03.82 (P04C01)

18-03-2020

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

REFERENCES CITED IN THE DESCRIPTION

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