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(54) **Tether system, guide element for use in a tether system, traveller line for use in the tether system, and method for tethered walking**

(57) A tether system for use on a roof (2), wherein the system (1) has a guide (3) provided on the roof (2), wherein the guide (3) is arranged for tethering a user (G) in order to allow the user (G) to just reach the edges (4) of the roof (2), characterized in that the guide (3) has a

shape which realizes that the edges (4) of the roof (2) are also reachable by the user in the corners (5) of the roof (2), without it being possible for the user to fall over the edge (4). Guide element (3) for use in such a tether system (1), to a traveling line for use in the said tether system (1) and to a method for tethered walking.

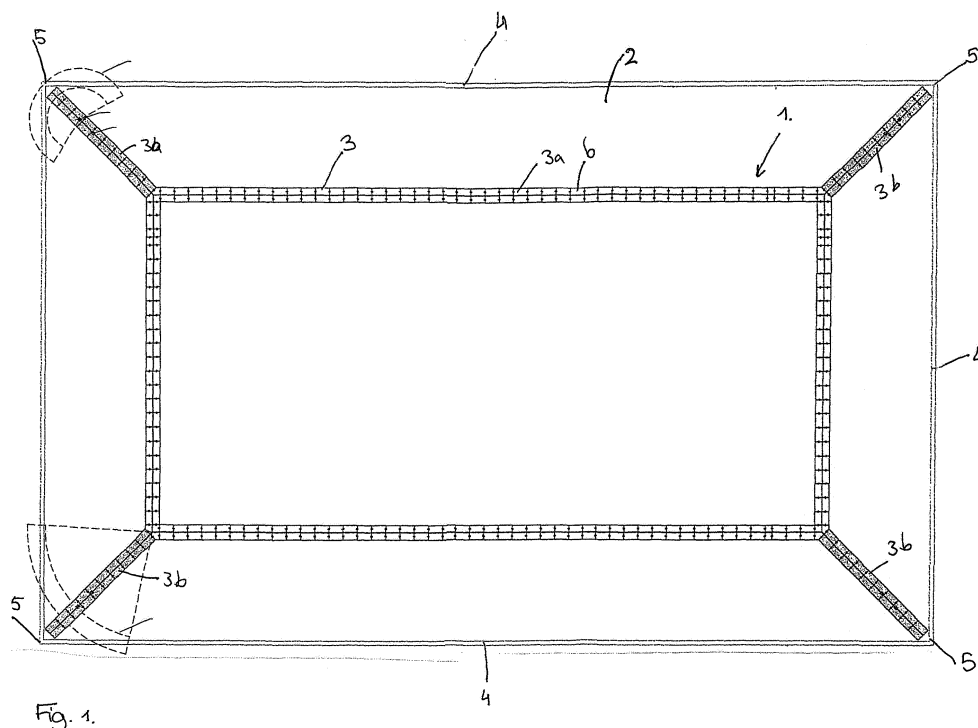


Fig. 1.

## Description

**[0001]** The invention relates to a tether system for use on a roof, wherein the system has a guide provided on the roof, wherein the guide is arranged for tethering a user in order to allow the user to just reach the edges of the roof.

**[0002]** Such a tether system is known from practice. Such a tether system is necessary to walk and work safely on a roof within the so-called danger zone on a roof, the area from 4 meters from the edge of the roof to the edge of the roof. These tether systems can be used on flat roofs or slightly inclined roofs. A known tether system comprises a guide located on the roof, usually located along the edges of the roof at a distance from those edges of the roof more towards the center of the roof. A user is tethered to the guide with a line, the line having a particular length so that the user can proceed to a particular distance from the guide, such that the user cannot fall off the roof. Such a guide may consist of a rail system, scaffolding pipes with concrete blocks and different guides. A drawback of the known systems is that the guide usually runs parallel to the edge of the roof and causes a problem in the corners in combination with a line with a fixed length. The user cannot reach to the corner and therefore cannot carry out any work either in the corners of the roof. If the line were longer, then there would be a danger of falling at the edges of the roof located between the corners because the line gives the user too much length at those locations and therefore there is a possibility that the user falls over the edge at those locations.

**[0003]** Therefore, the object of the invention is to provide a tether system, wherein the user can reach the whole edge of the roof including the corners in a manner such that the user can also carry out work there without being in danger of falling off the roof.

**[0004]** To this end, the invention provides a tether system according to the type mentioned in the introduction, characterized in that the guide has a shape which realizes that the edges of the roof are also reachable by a user in corners of the roof, without it being possible for the user to fall over the edge. This is particularly suitable because the user can approach the edges of the roof at all times without this causing extra danger of falling at the edges between the corners. Further, when the user proceeds near the corner of the roof, he has sufficient room to move to carry out work or repairs to the corner of the roof.

**[0005]** According to a further elaboration of the invention, the guide comprises a main guide extending substantially parallel to the edges of the roof, while the main guide is at a distance from the edges of the roof. The user can walk along the edge of the roof and work at the edge of the roof utilizing the main guide. The user continuously remains at a same distance from the edge of the roof. It is particularly favorable when the main guide is located at 4 meters from the edge of the roof, since the main guide then at the same time indicates the bound-

ary of the danger zone. Preferably, the guide can be provided with an optical marking, for instance a color marking in a bright color. This color marking then clearly indicates to the user where the danger zone starts.

**[0006]** According to a further elaboration of the invention, the shape of the guide extends from the main guide into the corners of the roof, while it forms at least one corner guide. The corner guide enables the users to easily approach the corner from the main guide. However, the user remains tethered during changing from the main guide to the corner guide and remains at a safe distance from the edge of the roof.

**[0007]** The invention further provides a guide with multiple guide elements, which elements are detachably interconnected. This is particularly favorable because the guide can easily be made up of the guide elements. The guide can simply be provided on different shapes of roofs with different dimensions. The guide elements can easily be detached and be removed. This is particularly convenient when a roofing on which a guide is provided needs to be replaced. After replacing the roofing, the guide elements are placed back again and interconnected again and the guide is again present. The guide elements may, for instance, be concrete slabs manufactured by means of pouring. This is favorable because the whole of the slabs then has such a weight that it can easily stop the weight of the user. Therefore the guide can be laid loose on the roof and no additional fixing means are needed which need to be mounted in or on the roof. Any leakage caused thereby is not in order with the system according to the invention.

**[0008]** According to a further elaboration of the invention, the guide elements are provided with a guide slot part, the guide slot parts of the elements being connected to one another and forming a guide slot. By connecting the guide elements, the guide slot is created through which a line which is fixed to a user can be moved slidably, such that the user can move along the edge of the roof with a constant movement. The main guide slot has the same diameter shape and diameter size at any location of the guide so that any catching of the line upon a change from the one element to the other element is minimal.

**[0009]** According to a further elaboration of the invention, the at least one corner guide comprises a stopper for stopping a line with which the user is tethered, so that the user cannot move further to the edges of the roof. This stopper provides an extra safeguard so that the user can move to a maximum distance viewed from the main guide in the direction of the corner of the roof. The user can reach the edge of the roof with his hands to thus carry out work, but his center of gravity remains sufficiently far from the edge of the roof to prevent falling.

**[0010]** According to an alternative embodiment of the invention, the at least one corner guide comprises a line belay device for belaying a line with which the user is tethered. The line belay device is a next extra safeguard. When the user approaches the corner, he needs to run

the line through the line belay device. The line belay device prevents the user from coming too close to the edge when the user moves from the corner parallel to the edge without first leaving the corner guide.

**[0011]** In a favorable elaboration of the invention, the guide slot of the corner guide has the same diameter as or a smaller diameter than the guide slot of the main guide and the guide slot is arranged for receiving a traveler. Depending on the location of the guide with respect to the edge of the roof, it is favorable if the guide slot of the corner guide has a smaller diameter than the guide slot of the main guide. If the guide also serves as a boundary of the danger zone and is therefore located approximately 4 meters from the edge of the roof, a line with a different length, i.e. a shorter line, can be used when the corner is approached, than when movement takes place along the main guide. It is safe that the traveler of the long line does not fit in the corner guide in order to prevent movement in the direction of the corner with too long a line.

**[0012]** According to a further elaboration of the invention, the system comprises a traveling line with at least one traveler. It is particularly favorable if the traveling line comprises two travelers, of which the one traveler has a first diameter and the second traveler has a second diameter. The different travelers may then be used in the guide slots with different diameters as mentioned hereinabove. The traveling line with two travelers further has the advantage that the user can always remain tethered when changing between the guide slots.

**[0013]** It is particularly favorable when the first traveler has a larger diameter than the second traveler, so that, according to a further elaboration of the invention, the first traveler is receivable in the guide slot of the main guide and the second traveler is receivable in the guide slot of the at least one corner guide. The larger traveler does not fit in the smaller guide slot and therefore the user is warned when he wants to slide the wrong traveler into the corner guide. The other way around, this is no problem. When the user wants to slide the small traveler into the guide with the larger diameter, that is possible, but the user is then tethered to a short line and will not be able to reach the edge. This does not cause any danger, however.

**[0014]** The invention further relates to a guide element for use in a tether system as described hereinabove, wherein the guide element has a guide slot in which a traveler is receivable.

**[0015]** In addition, the invention relates to a traveling line for use in a tether system as described hereinabove, wherein the traveling line comprises at least one traveler arranged for cooperation with a guide.

**[0016]** Finally, the invention relates to a method for tethered walking on a roof utilizing an above-described tether system, wherein a user can tether himself to a guide provided on the roof in order to reach edges of the roof, characterized in that the guide has a shape which enables the user to reach the edges of the roof also in corners of the roof.

**[0017]** Such a guide element, such a traveling line and such a method yield similar advantages as the ones mentioned with the tether system according to the invention.

**[0018]** Further elaborations of the invention are described in the subclaims and will hereinafter be explained in more detail, with reference to the drawings, in which:

Fig. 1 shows a top plan view of a tether system;

Fig. 2 shows a top plan view of a tether system;

Fig. 3 shows a detail of a tether system;

Fig. 4 shows a second detail of a tether system;

Figs. 5 and 6 show cross-sectional views of a tether system;

Fig. 7 shows a traveling line;

Fig. 8 shows a schematic top plan view of a corner guide;

Fig. 9 shows a schematic cross-sectional view of the corner guide of Fig. 8;

Fig. 10 shows a schematic top plan view of a corner guide; and

Fig. 11 shows a schematic cross-sectional view of the corner guide of Fig. 10.

**[0019]** In the Figures, same parts are designated by same reference numerals.

**[0020]** Figs. 1 and 2 show a top plan view of a tether system 1 for use on a roof 2. The tether system 1 has a guide 3 provided on the roof 2. The guide 3 is arranged for tethering a user (not shown) so that the user can reach the edges 4 of the roof 2, without it being possible for the user to fall over the edge. The shape of the guide 3 enables the user to also reach the edges 4 of the roof 2 in the corners 5. The guide 3 comprises a main guide 3a extending substantially parallel to the edges 4 of the roof 2. The main guide 3a is located at a distance from the edges 4 of the roof. In Fig. 1, the main guide 3a is, for instance, located at a statutory distance, for instance 4 meters from the edges 4 of the roof 2, while the main guide 3a also forms the boundary 6 of the danger zone of the roof 2. In Fig. 2, the main guide 3a is located at approximately 2 meters from the edges 4 of the roof 2. The boundary 6 of the danger zone is further removed from the edges 4 at approximately 4 meters from the edges 4 of the roof 2.

**[0021]** The shape of the guide 3 extends from the main guide 3a into the corners 5 of the roof 2 and thus forms the corner guides 3b. By means of these corner guides, the user of the tether system 1 can get far into the corners 5 to reach the edges 4 of the roof 2 in the corners 5.

**[0022]** Figs. 3 and 4 show a detail of the tether system 1. These Figures clearly show that the guide 3 comprises multiple guide elements 7. These elements 7 are provided with a guide slot part 8. The guide elements 7 are detachably interconnected, in this exemplary embodiment by means of dovetail joints 9. These joints may also be different joints or be joints provided on slab supports which may be provided under the guide elements. In connected condition, the guide slot parts 8 form a guide slot

8. Fig. 3 shows that the guide elements 7 may have different shapes and may be provided with different guide slot parts 8. Different shapes of guides intended for different types and shapes of roofs may be assembled with these different guide elements 7.

**[0023]** The guide elements 7 as shown herein are slabs poured from concrete. It is also possible to design and to manufacture the guide elements 7 in a different manner and to make them from different materials so that these elements 7 have the same properties as the above-described guide elements 7. Between the guide elements 7 and the roofing of the roof 2, supports 7a are provided. The guide slots 8 in the guide elements 7 may be provided with drainage holes (not shown), so that rain-water can easily be drained off and does not unnecessarily remain in the guide slots 8. In addition, the guide slot 8 may be coated on a surface on a side facing the traveler, for instance with a water and dirt-repellent coating. This coating prevents unnecessarily stiff guidance of the traveler through the guide slot.

**[0024]** Fig. 3 further shows the connection between the main guide 3a and the corner guide 3b. On the corner guide 3b, an entrance 10 for a traveler is provided.

**[0025]** Figs. 5 and 6 show a cross-sectional view. The guide slot 8a, 8b has a substantially round cross section with at least one diameter. The guide slot 8 may also have two different diameters. These are shown by guide slot 8a in Fig. 5 and guide slot 8b in Fig. 6. The diameter of guide slot 8a is larger than the diameter of guide slot 8b. This situation occurs with the tether system 1 of Fig. 1. The main guide 3a has a guide slot 8a with a larger diameter than the guide slot 8b of the corner guides 3b. The guide slots 8a, 8b are arranged for receiving travelers 11a, 11b. The traveler 11a, 11b has a traveling ball 12a, 12b which is receivable in the guide slot 8a, 8b and a traveling connection 13a, 13b with which the traveler 11a, 11b is connectable to a traveling line 14. The first traveler 11a can be received in the guide slot 8a of the main guide 3a and the second traveler 11b can be received in the guide slot 8b of the corner guide 3b. To this end, the first traveler 11a has a larger diameter than the second traveler 11b, while the first traveler 11a may, for instance, have a diameter of about 30 mm and the second traveler 11b, for instance, a diameter of about 20 mm. The guide slots 8a, 8b then have, for instance, a diameter of 35 mm and 25 mm, respectively. The traveler 11a, 11b has sufficient room when it is in the guide slot 8a, 8b to slide through the guide slot 8a, 8b without difficulties. However, the room is also sufficiently small to prevent the traveler from slipping from the guide slot when force is exerted thereon. The traveling ball is preferably from a hard plastic, which does not deform when force is exerted thereon. It is clear that, in this manner, a user G cannot slide the traveler 11a with the largest diameter into the guide slot 8b with the smallest diameter. This is favorable to the safety of the user G and will be explained in more detail with Figs. 8-11.

**[0026]** In the tether system 1 as shown in Fig. 2, which

is shown in more detail in Fig. 10, the diameter of the guide slot 8b of corner guides 3b is equally large as the diameter of the guide slot 8a of the main guide 3a. To use this tether system 1, the user G will need a line 14 with only one traveler 11b. This is because, viewed over the whole guide 3b, the diameter of the guide slots 8b is equally large and the difference to be bridged between the distance between the main guide 3a and the edge 4 of the roof and the length of the corner guide 3b can be bridged by using a stopper 17 and a line belay device 15.

**[0027]** Fig. 7 shows a traveling line 14 comprising two travelers 11a, 11b, the traveler 11b located closest to the user G having a smaller diameter. The traveling line 14 is connectable to a standard belt such as, in this Figure, for instance a lap belt 16. This may of course also be another type of harness with which a user G can be firmly connected with the traveling line 14. The travelers 11a, 11b provided on the traveling line 14 are located at a distance L from each other, the distance L being geared to the length of the corner guide 3b and consequently to the distance between the main guide 3a and the edge 4 of the roof.

**[0028]** Fig. 8 shows a top plan view of a small part of a tether system 1, namely a corner of a main guide 3a and one corner guide 3b. This tether system 1 is the system from Fig. 1, with the guide also indicating the boundary 6 of the danger zone. The distance between the main guide 3a and the edge 4 of the roof 2 is about 4 meters. By providing the guide 3 with a bright color, the guide 3 can also serve as an optical marking for the 4-meter zone. The user G is tethered to the tether system 1 by means of a traveling line 14. When the user G wishes to approach the edge 4 of the roof somewhere between two corners 5 of the roof 2, the user G will slide the traveler 11a into the guide slot 8a of the main guide 3a. When he is tethered in this manner, the user G can reach the edges 4 of the roof 2 and will be able to reach over the edge of the roof with his hands (see H1). His center of gravity remains above the roof 2 so that the user G cannot fall over the edge 4 of the roof 2. When the user G wishes to reach the corner 5 of the roof 2, he slides the traveler 11b into the guide slot 8b of the corner guide 3b. The traveler 11b is about 2 meters closer to the user G than the traveler 11a. The user G can proceed in the direction of the corner 5 until the traveler 11b slides against the stopper 17. The user cannot go further. The user slides the traveling line 14 through the line belay device 15 so that, with a sideward movement Z, the center of gravity of the user always stays sufficiently far above the roof 2 so that the user G cannot fall off the roof 2. Lines H2 and K2 show where the outermost reaching points are located of the hands and the knees of the user G, respectively. It is clear that the user G can reach the whole edge 4 of the roof in this manner, even in the corners 5.

**[0029]** Fig. 9 shows this situation in a cross-sectional view.

**[0030]** Figs. 10 and 11 show a top plan view and a cross-sectional view of the tether system 1 of Fig. 2. In

this situation, the guide 3 is at a smaller distance from the edge 4 of the roof, about halfway between the boundary 6 of the danger zone and the edge 4 of the roof. This guide may also be provided with a bright color in order to serve as an optical marking of the 2-meter zone. Because the guide 3 is provided at about 2 meters from the edge 4 of the roof and the difference between this distance and the distance between the corner 5 and the main guide 3a can be bridged well by the use of stopper 17 and line belay device 15, the traveling line 14 has only one traveler 11b. The stopper 17 prevents the user G from being able to walk on too far in the direction of the corner 5. When the traveling line 14 is run through the line belay device 15 upon approaching the corner 5 of the roof 2 when the traveler 11b is located in the guide slot 8b of the corner guide, the user G is prevented from being able to possibly lean too far over the edge 4 of the roof. Thus, the user G has a radius indicated by line H2 in contrast to radius H1 when the line belay device 15 is not used and the traveler 11b abuts the stopper 17.

**[0031]** It will be clear that the invention is not limited to the described exemplary embodiment but that various modifications are possible within the framework of the invention as defined by the claims. Thus, it is possible for the guide to comprise a guide rail over which a traveler is slidably guidable, while the guide has a main guide and a corner guide. With such a guide in the shape of the guide according to the invention, the same object is achieved. Further, different guide slots with different diameters and different shapes of cross-sections may be used in which different travelers may be used. The guide may optionally also be made up of different guide elements interconnected in a different manner. Further, the guide may also be fixedly provided on the roof.

## Claims

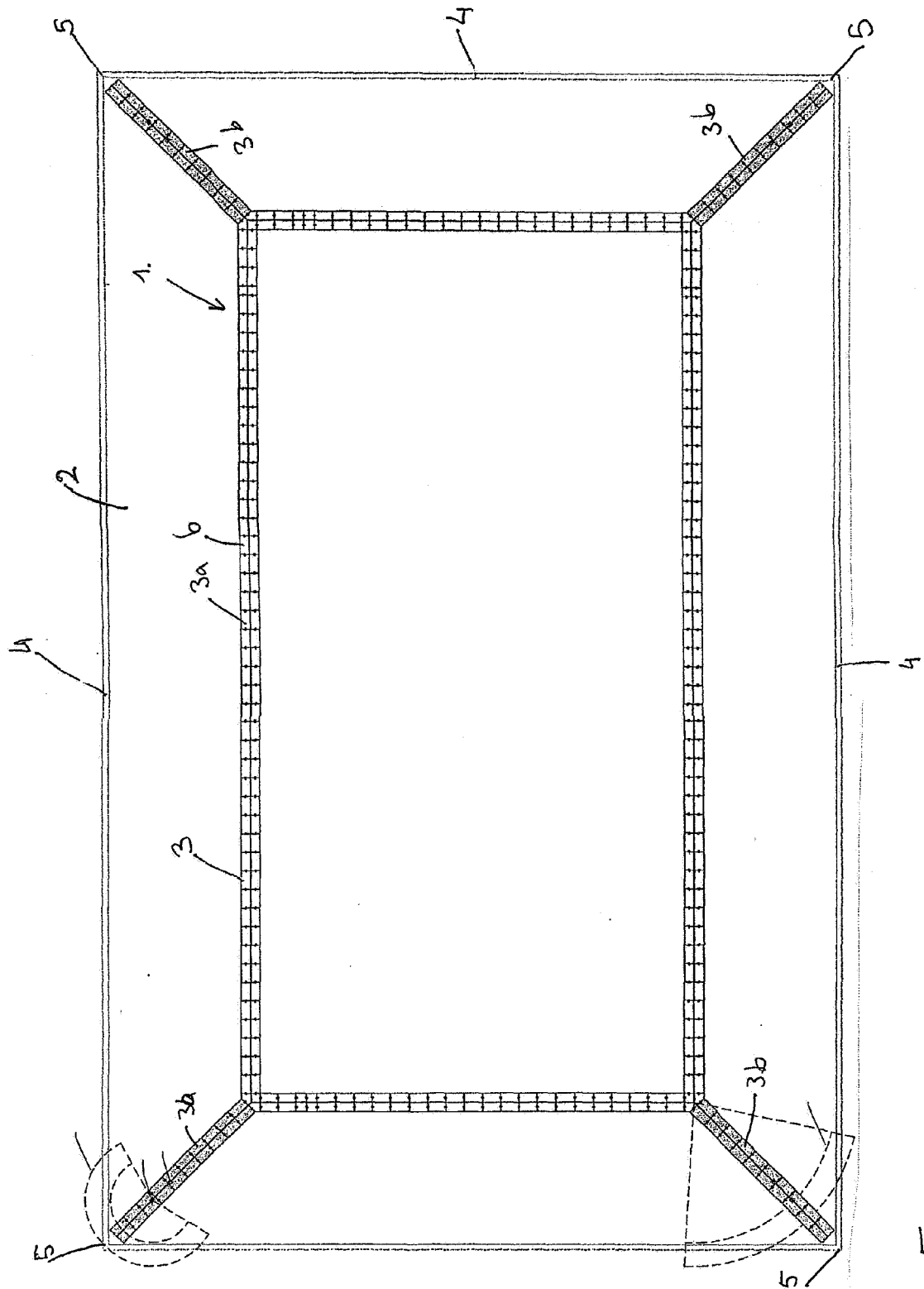
1. A tether system for use on a roof (2), wherein the system (1) has a guide (3) provided on the roof (2), wherein the guide (3) is arranged for tethering a user (G) in order to allow the user (G) to just reach the edges (4) of the roof (2), **characterized in that** the guide (3) has a shape which realizes that the edges (4) of the roof (2) are also reachable by the user (G) in the corners (5) of the roof (2), without it being possible for the user to fall over the edge of the roof.
2. A tether system according to claim 1, wherein the guide (3) comprises a main guide (3a) extending substantially parallel to the edges (4) of the roof (2), wherein the main guide (3a) is located at a distance from the edges (4) of the roof (2).
3. A tether system according to at least claim 2, wherein the guide (3) is provided with an optical marking, for instance a color marking in a bright color.
4. A tether system according to any one of claims 1-3, wherein the shape of the guide (3) extends from the main guide (3a) into the corners (5) of the roof (2), wherein it forms at least one corner guide (3b).
5. A tether system, optionally according to any one of the preceding claims, wherein the guide (3) comprises multiple guide elements (7), which elements (7) are detachably interconnected.
6. A tether system according to claim 5, wherein the guide elements (7) are provided with a guide slot part (8), wherein the guide slot parts (8) of the elements (7) are connected to one another and form a guide slot (8).
7. A tether system according to claim 5 or 6, wherein the guide elements (7) are slabs manufactured by means of pouring.
8. A tether system according to any one of claims 4-7, wherein the at least one corner guide (3b) comprises a stopper (17) for stopping a line (14) with which the user (G) is tethered, so that the user (G) cannot move further to the edges (4) of the roof (2).
9. A tether system according to any one of claims 4-8, wherein the at least one corner guide (3b) comprises a line belay device (15) for belaying a line (14) with which the user (G) is tethered.
10. A tether system according to any one of claims 6-9, wherein the guide slot (8) has a substantially round cross section with at least one diameter.
11. A tether system according to any one of claims 6-10, wherein the guide slot (8) has a substantially round cross section which has at least two different diameters.
12. A tether system according to any one of claims 6-11, wherein the guide slot (8b) of the corner guide (3b) has the same diameter as or a smaller diameter than the guide slot (8a) of the main guide (3a).
13. A tether system according to any one of claims 6-12, wherein the guide slot (8) is arranged for receiving a traveler (11).
14. A tether system according to at least claim 13, wherein the traveler (11) has a traveling ball (12) which is receivable in the guide slot (8) and has a traveling connection (13) with which the traveler (11) is connectable to a traveling line (14) connected with the user (G).
15. A tether system according to any one of the preceding claims, wherein the system (1) comprises a

traveling line (14) with at least one traveler (11).

16. A tether system according to any one of the preceding claims, wherein the system (1) comprises a traveling line (14) with two travelers (11) of which the one traveler (11a) has a first diameter and the second traveler (11b) has a second diameter. 5
17. A tether system according to claim 15 or 16, wherein the first traveler (11a) has a larger diameter than the second traveler (11b). 10
18. A tether system according to any one of claims 15-17, wherein the first traveler (11a) is receivable in the guide slot (8a) of the main guide (3a) and wherein the second traveler (11b) is receivable in the guide slot (8b) of the at least one corner guide (3b). 15
19. A tether system according to any one of claims 1-5, wherein the guide comprises a guide rail over which a traveler is slidably guidable. 20
20. A guide element for use in a tether system according to any one of claims 1-18, wherein the guide element (7) has a guide slot part (8) in which a traveler (11) is receivable. 25
21. A guide element according to claim 20, wherein the guide slot (8) is provided with drainage holes. 30
22. A guide element according to claim 20 or 21, wherein a surface of the guide slot (8) is coated on a side facing the traveler (11). 35
23. A guide element according to claim 22, wherein the coating is a water and dirt-repellent coating.
24. A guide element according to any one of claims 20-23, wherein the element (7) is a slab manufactured by means of pouring. 40
25. A traveling line for use in a tether system according to any one of claims 1-18, wherein the traveling line (14) comprises at least one traveler (11) arranged for cooperation with a guide (3). 45
26. A traveling line according to claim 25, wherein the traveling line comprises two travelers (11a, 11b) which travelers (11a, 11b) are located at a distance from each other. 50
27. A traveling line according to claim 25 or 26, wherein a first traveler (11a) has a larger diameter than a second traveler (11b). 55
28. A traveling line according to any one of claims 25-27, wherein the traveling line (14) is connectable to a

standard belt, for instance a lap belt (16).

29. A method for tethered walking on a roof utilizing a tether system (1) according to any one of claims 1-18, wherein a user (G) can tether himself to a guide (3) provided on the roof (2) in order to reach edges (4) of the roof (2), wherein the guide (3) has a shape which enables the user (G) to reach the edges (2) of the roof (4) also in corners (5) of the roof (2).
30. A method according to claim 29, wherein a traveling line (14) comprises two travelers (11a, 11b), wherein the user (G) slides the first traveler (11a) into the guide slot (8a) of the main guide (3a) before reaching the edges (4) of the roof (2), and wherein, upon reaching the corner guide (3b), the user (G) slides the second traveler (11b) into the guide slot (8b) of the corner guide (3b) to reach the edges (4) in the corners (5) of the roof (2).
31. A method according to any one of claims 29-30, wherein the traveling line (14) in the corner guide (3b) is stopped by a stopper (17) located on the corner guide (3b) so that the user (G) cannot move further to the corner (5).
32. A method according to any one of claims 29-31, wherein, upon approaching a corner (5), the user (G) runs the traveling line (14) through a line belay device (17) present on the corner guide (3b) so that the user (G) cannot go over the edge (4) of the roof (2).



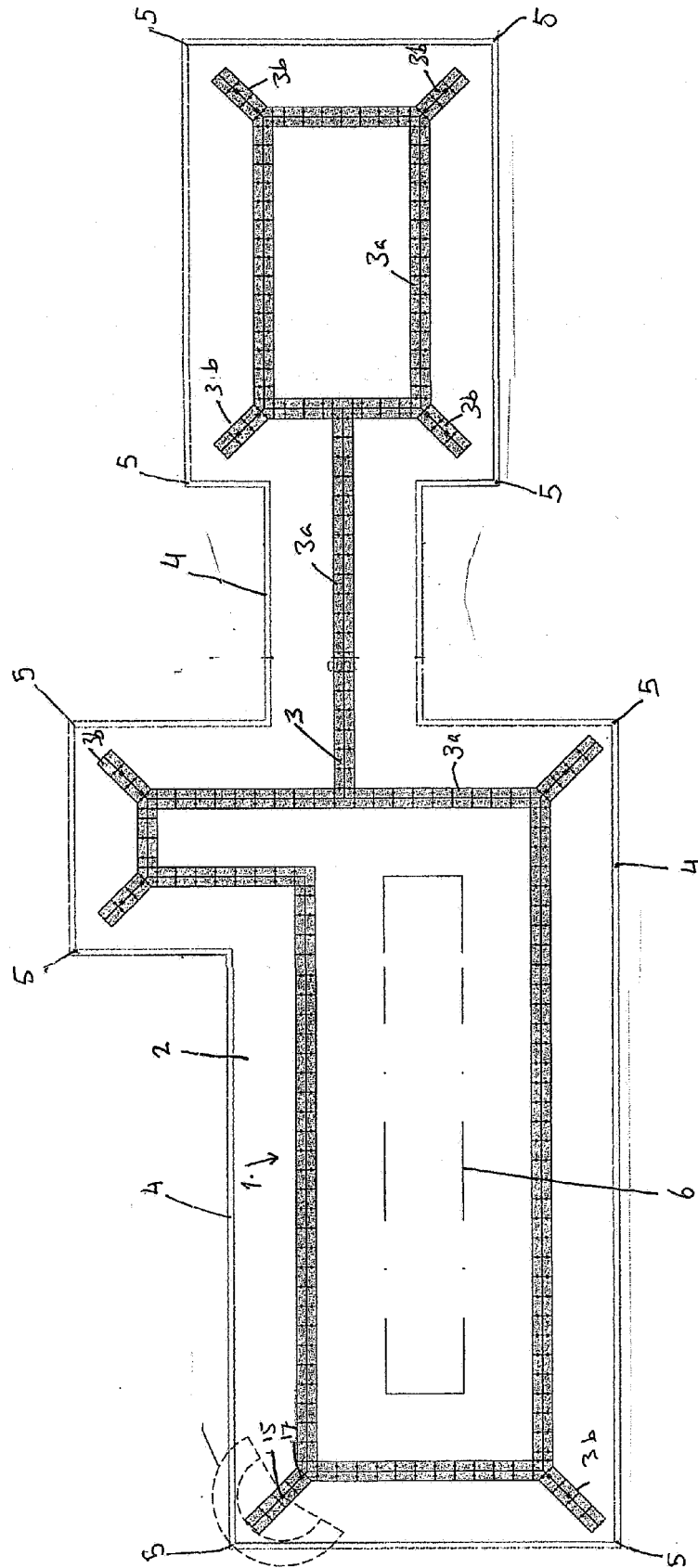


Fig. 2.



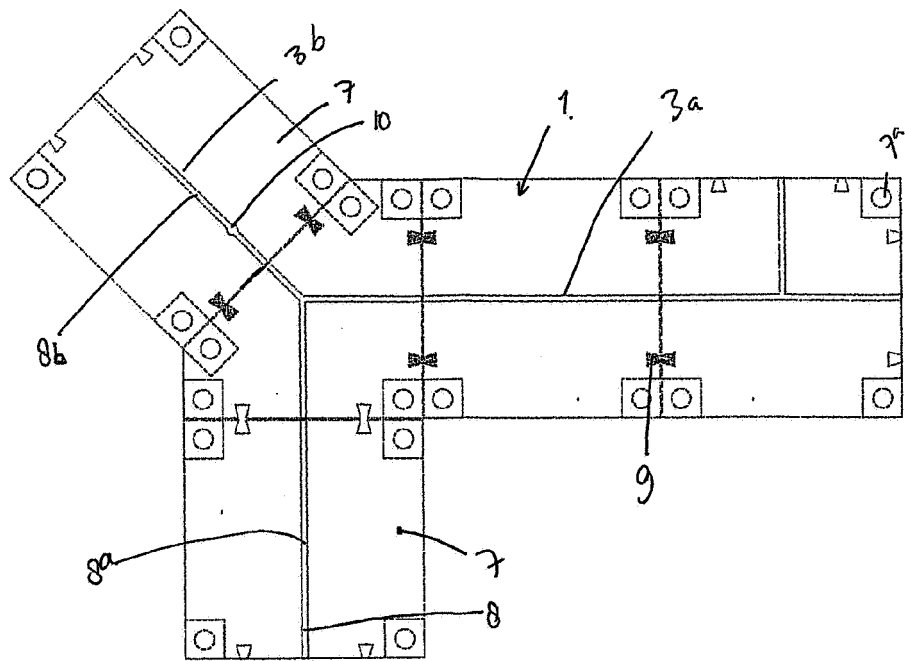


Fig 3

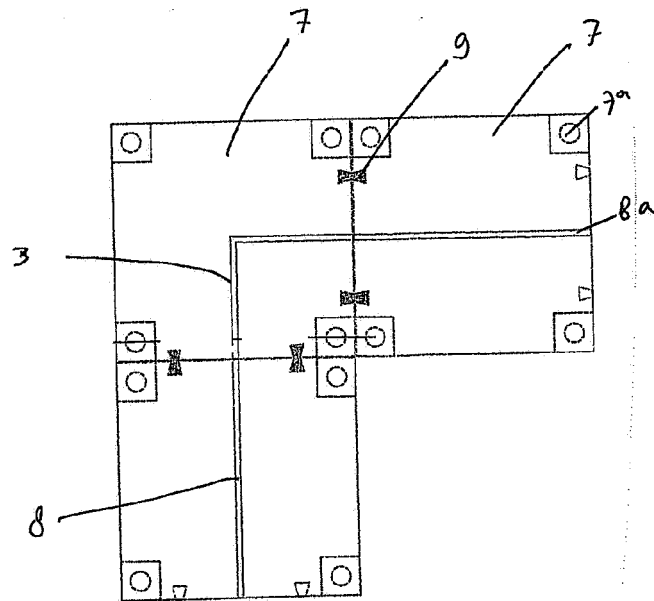


Fig 4

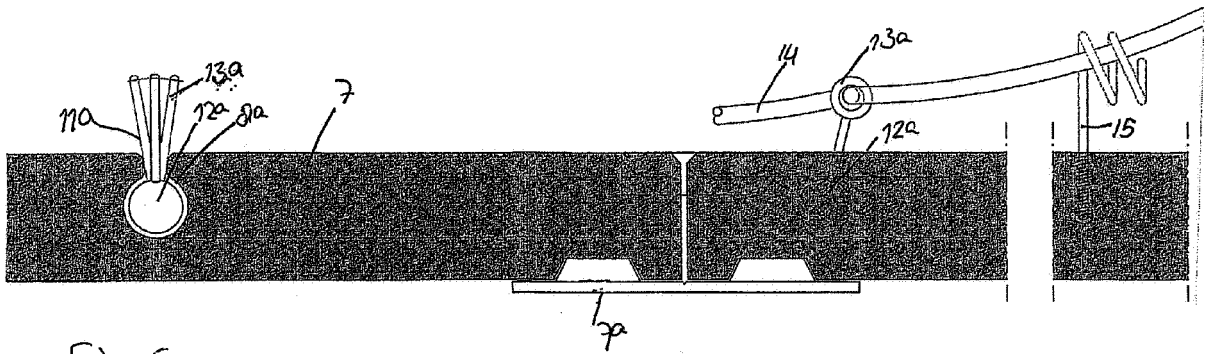


Fig 5.

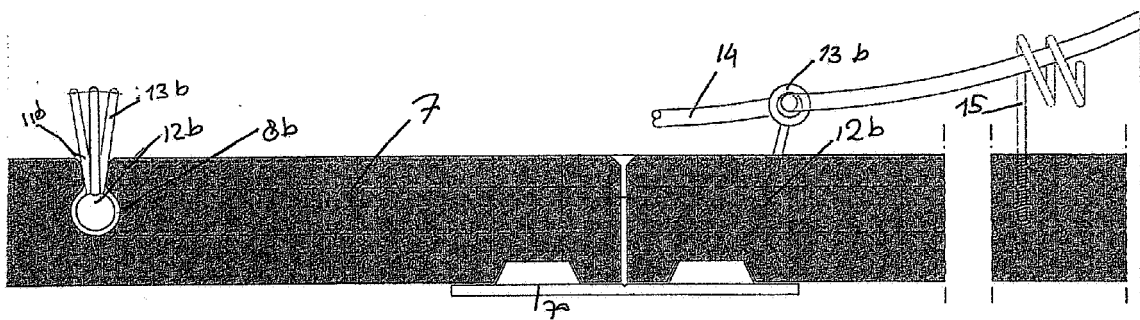


Fig 6.

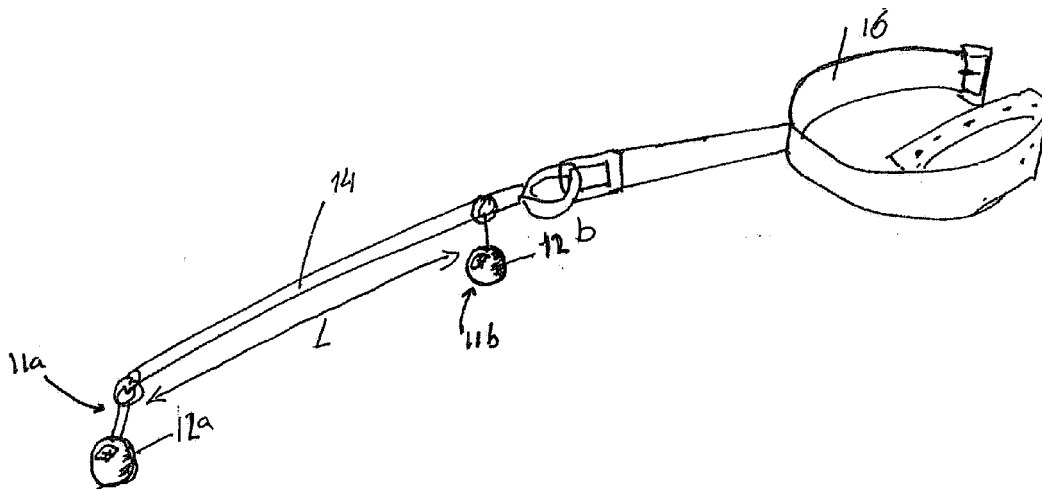
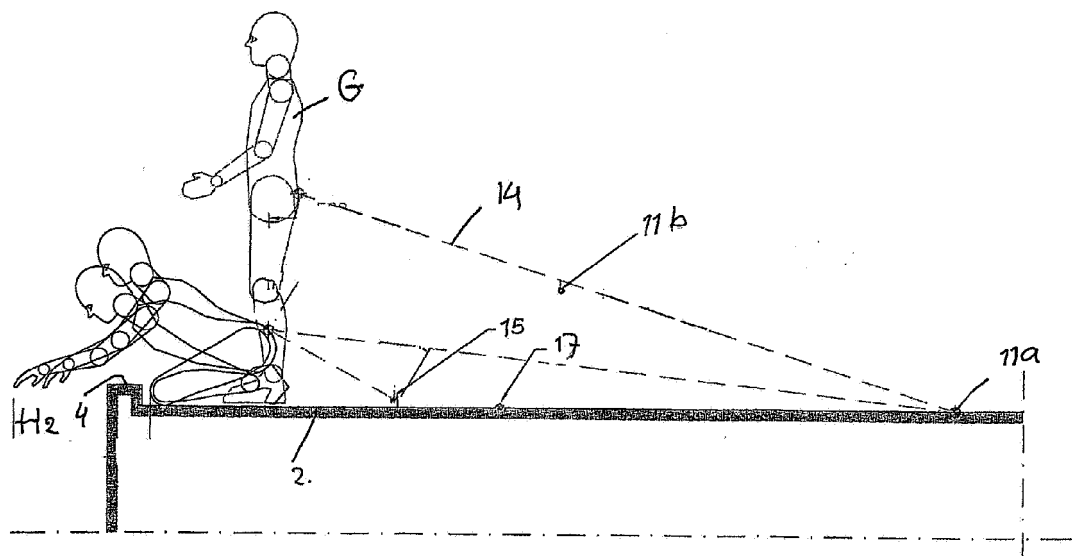
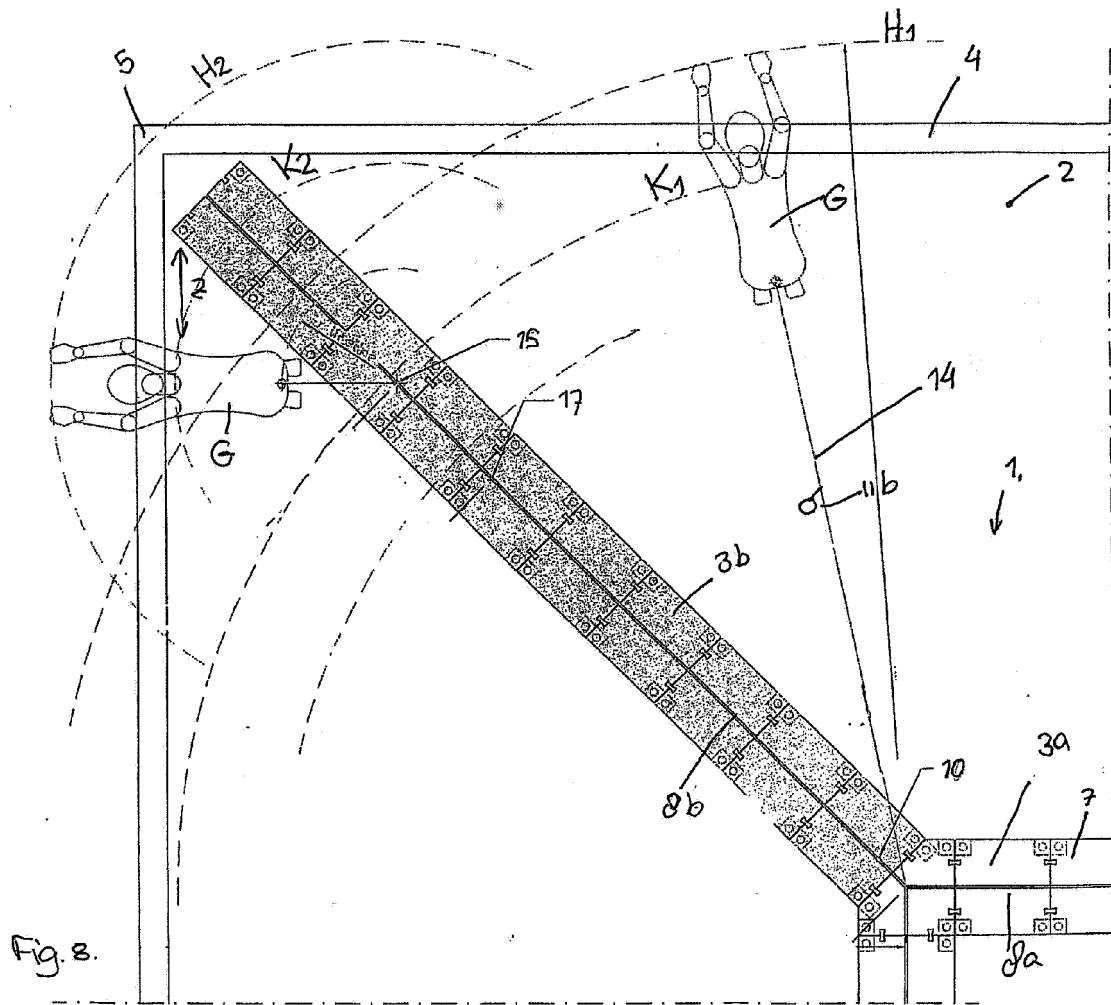


Fig 7.



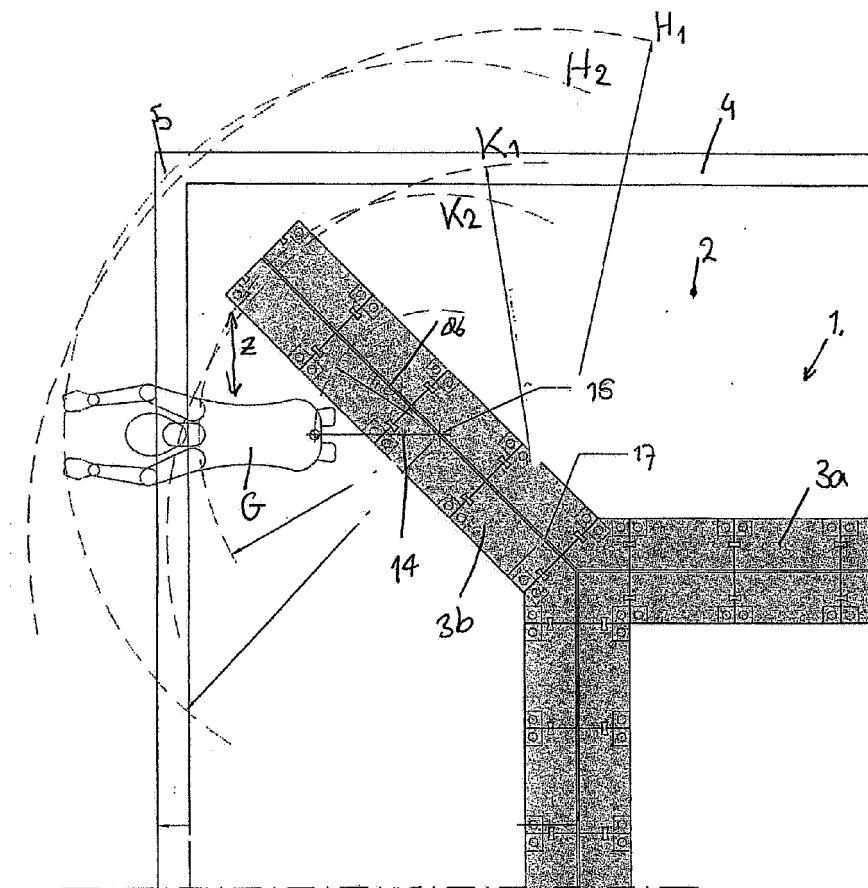


Fig. 10.

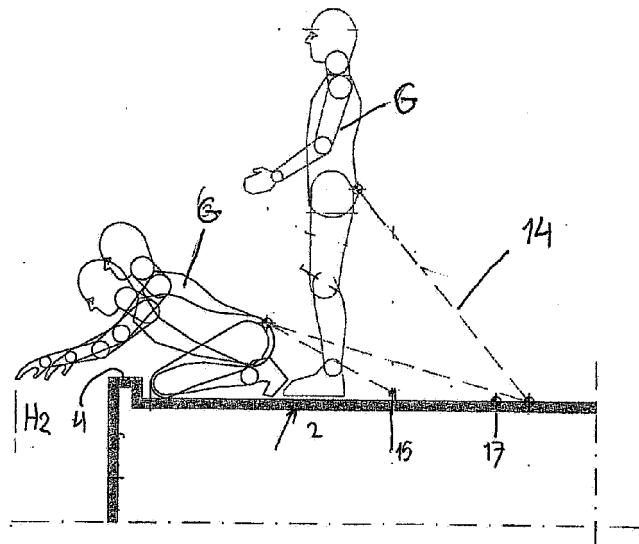


Fig 11.