

SECURING SYSTEM

The present patent application claims the priority benefit of French patent application FR16/61042 which is herein incorporated by reference.

Background

5 The present disclosure relates to a device for bracing a group of loads.

Discussion of the related art

10 For certain applications, it is desired to brace loads, for example, boxes, containers or accumulator batteries, in particular when the loads are arranged in a vehicle, for example, a ship, a plane, a train, a truck, etc. For this purpose, bracing devices are interposed between the loads and a reference element, for example, a ceiling or a wall.

15 Generally, it is desired for the bulk of the bracing device to be small and for the assembly and the disassembly of the bracing device to be simple. Further, the bracing device should be capable of being disassembled even after a long period of use. The operation of the bracing device thus has to be reliable and risks of blocking of the bracing device, for
20 example, due to the corrosion of mechanical parts, thus have to be low.

Further, for certain applications, in particular when the loads are distributed in an enclosure into layers stacked on one another and substantially totally fill the enclosure, the bracing devices which are inserted between the layer of loads at the top of the stack and the ceiling of the enclosure should fulfill additional constraints. Indeed, the bracing device should be compact to be capable of being inserted into such a confined space. Further, the narrowness of the space where the bracing devices are arranged between the layer of loads at the top of the stack and the ceiling of the enclosure, which for example has a height of some fifteen centimeters, may prevent the use of tools for the installation of the bracing devices, which require space to be handled, such as for example a mallet. Further, it has to be possible to actuate certain bracing devices which are not within an operator's reach. Further, the bracing load exerted by the bracing device should not exceed a threshold to avoid damaging the loads. Further, the bracing device should be able to receive a significant compressive load in the occurrence of shocks.

20 **Summary**

An object of an embodiment is to overcome all or part of the disadvantages of the previously-described bracing devices.

Another object of an embodiment is for the bracing device to be compact.

Another object of an embodiment is for the bracing device to only comprise mechanical parts.

Another object of an embodiment is for the bracing device to be able to be activated by a remote control.

Another object of an embodiment is to be able to actuate a plurality of bracing devices with the same control unit.

Another object of an embodiment is for the bracing device to be reusable.

Thus, an embodiment provides a bracing system comprising a plurality of bracing devices, each bracing device comprising an endless screw cooperating with a toothed wheel, a nut coupled to the toothed wheel and comprising a first at least partly threaded opening, an at least partly threaded rod cooperating with the first opening, a plate coupled to the rod, and a torque-limiting mechanism between the wheel and the nut or between a drive shaft and the endless screw, wherein the endless screws of the bracing devices are simultaneously rotated by a drive mechanism.

According to an embodiment, for each bracing device, the endless screw is capable of being driven in a first rotation direction, whereby the plate displaces in a first direction, and is capable of being driven in a second rotation direction opposite to the first rotation direction, whereby the plate displaces in a second direction opposite to the first direction.

According to an embodiment, for each bracing device, the torque-limiting mechanism is capable of transmitting a first moment to the nut when the endless screw is driven in the first rotation direction by a second moment and of transmitting a third moment to the nut when the endless screw is driven in the second rotation direction by a fourth moment, the intensity in absolute value of the second moment being greater than the intensity in absolute value of the first moment for a same intensity in absolute value of the second and third moments.

According to an embodiment, for each bracing device, the rod is capable of disengaging from the nut when the plate is displaced in the second direction beyond a given position.

According to an embodiment, for each bracing device, the rod is capable of cooperating again with the nut after the plate has been displaced in the second direction beyond the given position when the endless screw is driven in the first rotation direction.

According to an embodiment, each bracing device comprises a part forming a sliding joint with the rod.

According to an embodiment, the joint between the endless screw and the toothed wheel and/or between the rod and the nut is an irreversible joint.

According to an embodiment, the torque-limiting mechanism comprises a dog rotated by the drive shaft and comprising first teeth and the endless screw comprises, on one side, second teeth, complementary to the first teeth, the second teeth being capable of sliding on the first teeth in a rotation direction when the resistive torque of the endless screw is greater than a threshold.

According to an embodiment, the device comprises a first spring permanently pushing the dog against the endless screw.

According to an embodiment, the wheel comprises first teeth cooperating with the endless screw and is crossed by a second opening comprising second teeth, the nut extending in the second opening, the torque-limiting mechanism comprising fingers radially arranged with respect to the nut, each finger comprising third teeth, complementary to the second teeth, the third teeth being capable of sliding on the second teeth in a rotation direction when the resistive torque of the nut is greater than a threshold.

According to an embodiment, the device comprises, for each finger, at least one second spring permanently pushing the finger against the second teeth.

According to an embodiment, the first opening comprises a first threaded portion and a second non-threaded portion and the rod comprises a third threaded portion and a fourth non-threaded portion, and the third threaded portion no longer meshes with the first threaded portion when the plate is at closest to the nut.

According to an embodiment, the device comprises a third spring permanently pushing on the rod.

According to an embodiment, the device comprises a foot and an alternation of first and second disks, each first

disk rotating along with the foot and each second disk rotating along with the nut, the first disks being capable of coming into contact with the second disks when the plate runs into an obstacle.

5 An embodiment also provides a bracing system comprising a plurality of bracing devices such as previously defined.

 According to an embodiment, the endless screws of the bracing devices are simultaneously rotated by a drive mechanism.

10 According to an embodiment, at least two of the bracing devices are coupled to each other by a rigid joint.

 According to an embodiment, all the bracing devices are coupled to one another by rigid joints.

 An embodiment also provides a load bracing method comprising installing the bracing system such as previously defined
15 between the loads and a wall and simultaneously actuating the bracing devices until the plate of each bracing device comes into contact with the wall.

Brief description of the drawings

20 The foregoing and other features and advantages will be discussed in detail in the following non-limiting description of specific embodiments in connection with the accompanying drawings, among which:

 Figures 1 and 2 are partial simplified cross-section
25 views of an assembly of loads held by bracing systems;

 Figure 3 is a perspective view of an embodiment of a bracing system comprising a plurality of bracing devices;

 Figures 4 and 5 respectively are a top view and a cross-section view, partial and simplified, of the bracing
30 system shown in Figure 3, which illustrate the operation thereof;

 Figure 6 is a view similar to Figure 5 in the case where the clearances compensated by the bracing systems are different;

Figures 7 and 8 respectively are an exploded perspective view and a lateral cross-section view of an embodiment of one of the bracing devices of the bracing system shown in Figure 3;

5 Figures 9 to 11 respectively are an exploded perspective view, a lateral cross-section view, and a top cross-section view of another embodiment of one of the bracing devices of the bracing system shown in Figure 3;

Figure 12 is a detail view of Figure 11;

10 Figures 13 and 14 respectively are a view similar to Figure 12 and a lateral cross-section view of another embodiment of one of the bracing devices of the bracing system shown in Figure 3; and

15 Figures 15 and 16 are perspective views of mechanical parts of the bracing device shown in Figure 14.

Detailed description

20 The same elements have been designated with the same reference numerals in the different drawings. For clarity, only those elements which are useful to the understanding of the described embodiments have been shown and are detailed. In the following description, when reference is made to terms qualifying absolute positions, such as terms "front", "rear", "top", "bottom", "left", "right", etc., or relative positions, such as terms "above", "under", "upper", "lower", etc., or to
25 terms qualifying directions, such as terms "horizontal", "vertical", etc., it is referred to the orientation of the drawings or to a bracing device in a normal position of use. The terms "approximately", "substantially", and "in the order of" are used herein to designate a tolerance of plus or minus 10%,
30 preferably of plus or minus 5%, of the value in question.

Figures 1 and 2 are partial simplified side views along two perpendicular directions of an assembly of loads 10 arranged in an enclosure 12 delimited by a frame 14 and distributed in horizontal layers 16 stacked on one another, each
35 layer 16 comprising loads 10 arranged next to one another. As an

example, four layers 16 are shown in Figure 1. Loads 10 for example correspond to boxes, containers, or to accumulator batteries. Bracing systems 20, each comprising a line of bracing devices 22 coupled to one another, are interposed between loads 10 of layer 16 at the top of the stack and ceiling 24 of enclosure 12.

Figure 3 is a perspective view of an embodiment of bracing system 20. Bracing system 20 comprises a plurality of bracing devices 22. Each bracing device 22 comprises a housing 28 supported by a foot 30, housing 28 containing a screw jack capable of displacing a plate 32 along a direction V in both directions.

In the present embodiment, each bracing device 22 is coupled to at least another bracing device 22, possibly to two bracing devices 22, by a rigid joint 34. Each rigid joint 34 for example comprises a hollow rigid pipe, and the housing 28 of each bracing device 22 comprises at least one tenon 36 capable of being fitted into pipe 34. In Figure 3, each bracing device 22 is shown with two tenons 36 arranged on either side of housing 28, so that bracing devices 22 can be coupled to one another to form a line of bracing devices 22. Rigid pipes 34 may have different lengths to enable to adapt the arrangement of bracing devices 22 to the loads 10 supporting them.

According to another embodiment, instead of being aligned, the bracing devices 22 may follow a broken line, and the housing 28 of each bracing device 22 can then comprise a plurality of tenons at different locations to allow the assembly of each bracing device 22 to one or two bracing devices according to a plurality of different configurations.

Each bracing device 22 comprises a drive screw, not shown in Figure 3, housed in portion 38 of housing 28 which, when it is rotated, enables to actuate the screw jack of bracing device 22. Bracing system 20 comprises a mechanism 40 of simultaneous control of bracing devices 22. According to an embodiment, control mechanism 40 comprises a rigid shaft 44

having an axis D which extends through each drive screw and is capable of rotating the drive screws. According to another embodiment, control mechanism 40 comprises a plurality of shafts, each shaft coupling the drive screw of one of bracing devices 22 to the drive screw of another bracing device. Control mechanism 40 may comprise mechanical coupling devices, for example, cardan joints or constant-velocity joints, shaft 44 being replaced with successive shafts coupled together by mechanical coupling devices. This enables to compensate for misalignments between the drive screws of bracing devices 22 in the case where bracing devices 22 are aligned, or to couple the drive screws of bracing devices 22 to one another in the case where bracing devices 22 are not aligned.

Figures 4 and 5 illustrate the operation of the bracing system 20 shown in Figure 3. An operator uses a tool 46, for example, a mechanical screwdriver or an electric screwdriver fitted with a bushing of complementary shape, to rotate shaft 44. All the drive screws of bracing devices 22 are simultaneously actuated. The plates 32 of bracing devices 22 are then displaced simultaneously.

According to an embodiment, each bracing device 22 comprises a mechanism of automated stopping of the displacement of plate 32 when the load exerted by plate 32 on ceiling 24 exceeds a threshold. The stopping mechanism however does not prevent the rotation of shaft 44.

Figure 6 illustrates the case where the displacements of the plates 32 of bracing devices 22 are not the same. Further, as shown in Figure 6, plates 32 may be articulated to incline according to the orientation of the surface against which they bear.

The characteristics of the threaded elements contained in bracing device 22 are selected so that bracing device 22 is not reversible, that is, a rotation of shaft 44 causes a translational motion of plate 32 but a translational motion of plate 32 does not cause a rotation of shaft 44. This advantageously

enables to avoid an undesired rotation of shaft 44, for example, when a shock is exerted on plate 32.

Figures 7 and 8 show an embodiment of bracing device 22, housing 28 not being shown in Figure 7.

5 Bracing device 22 comprises a support 50 affixed to housing 28 comprising two cylindrical openings 52 having a circular base of axis D. A bearing 54 is pivotally assembled in each opening 52. Each bearing 54 is crossed by an opening 56 having a hexagonal base. Shaft 44, only shown in Figure 8, runs
10 through openings 56 and has a shape complementary to that of openings 56, for example, a hexagonal cross-section, so that the rotating of shaft 44 around axis D causes the rotation of each bearing 54 around axis D.

 Bracing device 22 further comprises an endless screw
15 58 having an axis D, corresponding to the previously-described drive screw, comprising an external threading 59, crossed by a cylindrical opening 60 with a circular base having shaft 44 extending into it. Endless screw 58 is assembled to freely rotate around shaft 44. Bracing device 22 comprises a torque-
20 limiting and uncoupling mechanism 61 comprising a dog 62 arranged on one side of endless screw 58. Dog 62 is crossed by an opening 63 with a hexagonal base having a shape complementary to that of shaft 44, so that the rotating of shaft 44 around axis D causes the rotation of dog 62 around axis D. Dog 62 is
25 coupled by a slide joint along axis D to shaft 44. Uncoupling mechanism 61 comprises a spring 64, interposed between dog 62 and one of bearings 54, which maintains dog 62 pressed against a side of endless screw 58, the other side of endless screw 58 coming into contact with the other bearing 54. Dog 62 comprises
30 teeth 66, for example, helical teeth, on the side opposite endless screw 58. Endless screw 58 comprises teeth 68 on the side opposite dog 62. Teeth 66 and 68 have complementary shapes.

 Bracing device 22 further comprises a toothed wheel 70 of axis E rotated by endless screw 58. Wheel 70 comprises
35 external teeth 71 permanently meshing with threading 59 of

endless screw 58. Bracing device 22 further comprises a nut 72 assembled to freely rotate around axis E with respect to foot 30. Wheel 70 rotates nut 72 around axis E. Nut 72 is coupled by a slide joint along axis E to wheel 70. For this purpose, wheel
5 70 may be crossed by an opening 74 of axis D with a non-circular, for example, rippled, base and nut 72 may comprise a body 76 having a portion arranged in opening 74 and having a shape complementary to that of opening 74. Foot 30 may comprise a recess 78 with a circular base having body 76 pivotally
10 assembled therein. Nut 72 is crossed by a circular opening 80 of axis E which comprises a threaded portion 82, on the side of plate 32, and a smooth portion 84 on the side of foot 30. Bracing device 22 further comprises a rod 86 of axis E which comprises a threaded portion 88, on the side of foot 30,
15 continued by a smooth portion 89, on the side of plate 32, threaded portion 88 cooperating with threaded portion 82 of opening 80 of nut 72. Plate 32 is coupled to the end of rod 86 opposite to nut 72 by a ball joint 90, an element of ball joint 90 being fastened to rod 86 by a screw 92. A spring, not shown
20 is provided between foot 30 and the lower end of rod 86.

Bracing device 22 further comprises a flange 94 fastened to housing 28 by screws 96 and crossed by an opening 98 for the passage of rod 86. Rod 86 is assembled by a slide joint along axis E with respect to flange 94. For this purpose, smooth
25 portion 89 of rod 86 may comprise a flat section 100 and opening 98 may have a shape complementary to that of smooth portion 89.

According to an embodiment, torque-limiting mechanism 61 further comprises a clutch mechanism 102 housed in a recess 101 provided in foot 30. Clutch mechanism 102 is formed by a
30 stack of disks 103 interposed with disks 104. Disks 103 and 104 are assembled by a slide joint along axis E with respect to foot 30 and to nut 72. However, disks 103 rotate along with nut 72 around axis E and disks 104 rotate along with foot 30 around axis E. For this purpose, according to an embodiment, each disk
35 103 has a circular outer edge and is crossed by an opening 106

having body 76 of nut 72 extending into it and having a shape complementary to that of body 76. Further, recess 101 has a non-circular, for example, rippled, base and each disk 104 has an outer edge having a shape complementary to that of recess 101
5 and is crossed by an opening 108 having body 76 assembled to freely rotate therein.

Bracing device 22 operates as follows. The rotating of shaft 44 around axis D in a first rotation direction causes the rotation of endless screw 58 in the same rotation direction by
10 friction of teeth 66 of dog 62 against the lateral teeth 68 of endless screw 58. The rotation of endless screw 58 causes the rotation of wheel 70 and of nut 72 around axis E in a first rotation direction. This causes a displacement of rod 86 along axis E, by cooperation of smooth portion 89 and of a flange 94,
15 to draw plate 32 away from housing 28.

When plate 32 comes into contact with an obstacle, the effort which opposes the displacement of plate 32 results in an increase in the resistive torque put up by endless screw 58 against its rotating by dog 62. If the resistive torque is
20 larger than the drive torque due to the friction between teeth 66 of dog 62 against teeth 68 of endless screw 58, teeth 66 of dog 62 slide on the lateral teeth 68 of endless screw 58 and endless screw 58 is no longer rotated by shaft 44. The displacement of plate 32 is then interrupted. Shaft 44 may
25 however keep on actuating other bracing devices 22 to which it is connected.

The interruption of the displacement of plate 32 may be obtained for relatively light efforts of plate 32 against ceiling 24 and thus prevent any deterioration of the load
30 having bracing device 22 resting thereon. Indeed, when plate 32 comes into contact with an obstacle, rod 86 transmits an effort to nut 72, which causes the pressing of disks 103 against disks 104. An abrupt increase in the drive torque necessary to rotate nut 72 and thus endless screw 58 is thus obtained, for example,
35 at values in the order of from 5 Nm to 10 Nm. This favors the

sliding of dog 62 with respect to endless screw 58. If clutch mechanism 102 was not present dog 62 should slide on endless screw 58 for a low resistive torque which might easily be unintentionally reached, for example, due to dynamic effects due to the high rotation speed of the electric screwdriver rotating shaft 44.

The rotating of shaft 44 around axis D in the second rotation direction opposite to the first rotation direction causes the rotation of endless screw 58 in the second rotation direction since teeth 66 of dog 62 mesh with teeth 68 of endless screw 58. The rotation of endless screw 58 causes the rotation of wheel 70 and of nut 72 around axis E in the second rotation direction. This causes a displacement of rod 86 along axis E, by cooperation of smooth portion 89 and of a flange 94, to take plate 32 closer to housing 28. When plate 32 is sufficiently close to housing 28, threaded portion 88 of rod 86 disengages from threaded portion 82 of opening 80 of nut 76. The displacement of plate 32 is then interrupted. The spring, not shown, provided between foot 30 and the lower end of rod 86 enables to keep threaded portion 88 of rod 86 pressed against threaded portion 82 of opening 80 to make sure that threaded portion 88 of rod 86 meshes again with threaded portion 82 of opening 80 at the next rise of plate 32.

This enables, when a plurality of devices 22 are simultaneously rotated by a drive mechanism 40, for the plates 32 of devices 22 to stop one after the others while the driving of devices 22 is not interrupted.

The pitch of the thread of endless screw 58, of threaded portion 82 of opening 80, and of threaded portion 88 of rod 86, and the friction coefficients between the materials forming endless screw 58, nut 76, and rod 86 are selected so that bracing device 22 is not reversible.

Figures 9 to 12 show another embodiment of a bracing device 110. Bracing device 110 comprises all the elements of bracing device 20, with the difference that torque-limiting

mechanism 61 is replaced with a torque-limiting mechanism 112 arranged between wheel 70 and nut 72, that rod 86 is threaded along its entire length, that opening 80 of nut 72 is threaded along its entire length, and that the function carried out by
 5 flange 94 of bracing device 20 is carried out by a lug 114. In Figures 9 to 11, endless screw 58 and shaft 44 are a single mechanical part. As a variation, endless screw 58 and shaft 44 may be two different parts, endless screw 58 being directly rotated around axis D by shaft 44.

10 According to an embodiment, nut 72 rotates around axis E of fingers 116. Each finger 116 is partially housed in a recess 118 formed in nut 72 and is capable of radially sliding with respect to nut 72. The end of each finger 116 forms a tooth 119 having two tapered surfaces 122, 124. The central opening 74
 15 of wheel 70 comprises teeth 120 with which fingers 116 are capable of meshing. Springs 126 are arranged in each recess 118 and permanently push the associated finger 116 against teeth 120.

In the embodiment shown in Figures 9 to 12, to allow
 20 the assembly of bracing device 110, housing 28 is in two parts. Further, wheel 70 is sandwiched between nut 72 and a part 128 rotating along with nut 72 around axis E. Lug 114 is affixed to foot 30 by a screw 130. Rod 86 comprises a non-through opening 132 of axis E with a non-circular cross-section, having lug 114
 25 housed into it. The outer shape of lug 114 is complementary to that of opening 132.

Bracing device 110 operates as follows. The rotating of endless screw 58 around axis D in a first rotation direction causes the rotation of wheel 70 around axis E in a first
 30 rotation direction. The rotation of wheel 70 causes the rotation of nut 72 around axis E in the first rotation direction by friction of surfaces 122 of fingers 116 against teeth 120. This causes a displacement of rod 86 along axis E, by cooperation of lug 114 and of opening 132, to draw plate 32 away from housing
 35 28.

When plate 32 comes into contact with an obstacle, the effort which opposes the displacement of plate 32 results in a resistive torque which opposes the rotation of nut 72. If the resistive torque is larger than the drive torque due to the friction between surfaces 122 of fingers 116 against teeth 120, fingers 116 slide on teeth 120 and nut 72 is no longer rotated by wheel 70. The displacement of plate 32 is then interrupted. The actuation of the other bracing devices 110 of the bracing system can however carry on.

The rotating of endless screw 58 around axis D in the second rotation direction opposite to the first direction causes the rotation of wheel 70 around axis E in the second rotation direction. The rotation of wheel 70 causes the rotation of nut 72 around axis E in the second rotation direction by friction of surfaces 124 of fingers 116 against teeth 120. This causes a displacement of rod 86 along axis E, by cooperation of lug 114 and of opening 132, to bring plate 32 closer to housing 28.

As appears in Figure 12, the inclinations of surfaces 122, 124 with respect to a median plane of finger 116 containing axis E are not equal, so that the friction of surfaces 124 against teeth 120 when wheel 70 rotates in the second rotation direction is more significant than the friction of surfaces 122 against teeth 120 when wheel 70 rotates in the first rotation direction. This enables to apply a more significant torque to rod 86 to start the coming down of plate 32 from the high position. Further, when rod 86 reaches a low position in contact with housing 28, surfaces 124 may slide with respect to teeth 120 of wheel 70 so that wheel 70 no longer rotates nut 72.

The pitch of the thread of endless screw 58, of opening 80, and of rod 86, and the friction coefficients between the materials forming these parts are selected so that bracing device 110 is not reversible.

Figures 13 to 16 show another embodiment of a bracing device 140. Bracing device 140 comprises all the elements of bracing device 110, with the difference that, for each finger

116, surface 124 extends parallel to the median plane of finger 116 containing axis E and rod 86 comprises a threaded portion 88 and a non-threaded portion 89, like the bracing device 20 shown in Figures 7 and 8, and opening 80 comprises a threaded portion 5 82 and a non-threaded portion 84 like bracing device 20. A spring, not shown, is provided between foot 30 and the lower end of rod 86 and may be arranged in a housing 142 provided at the lower end of rod 86.

The operation of bracing device 140 for the rise of 10 plate 32 is identical to what has been previously described for bracing device 110. The operation of bracing device 140 for the descent of plate 32 is identical to what has been previously described for bracing device 20. In particular, when plate 32 has been taken sufficiently close to housing 28, the threaded 15 portion 88 of rod 86 disengages from threaded portion 82 of opening 80 of nut 72. The displacement of plate 32 is then interrupted. The spring, not shown, provided between foot 30 and the lower end of rod 86 enables to keep threaded portion 88 of rod 86 pressed against threaded portion 82 of opening 80 to make 20 sure that threaded portion 88 of rod 86 meshes again with threaded portion 82 of opening 80 at the next rise of the plate.

Various embodiments with different variations have been described hereabove. It should be noted that those skilled in the art may combine these various embodiments and variations 25 without showing any inventive step.

CLAIMS

1. A bracing system comprising a plurality of bracing devices (22; 110; 140), each bracing device comprising an endless screw (58) cooperating with a toothed wheel (70), a nut (72) coupled to the toothed wheel and comprising a first at least partly threaded opening (80), an at least partly threaded rod (86) cooperating with the first opening, a plate (32) coupled to the rod, and a torque-limiting mechanism (61) between the wheel and the nut or between a drive shaft (44) and the endless screw, wherein the endless screws (58) of the bracing devices (22) are simultaneously rotated by a drive mechanism (40).

2. The bracing system of claim 1, wherein, for each bracing device (22; 110; 140), the endless screw (58) is capable of being driven in a first rotation direction, whereby the plate (32) is displaced in a first direction, and is capable of being driven in a second rotation direction opposite to the first rotation direction, whereby the plate (32) is displaced in a second direction opposite to the first direction.

3. The bracing system of claim 2, wherein, for each bracing device (110; 140), the torque-limiting mechanism (61) is capable of transmitting a first moment to the nut (70) when the endless screw (58) is driven in the first rotation direction by a second moment and to transmit a third moment to the nut when the endless screw (58) is driven in the second rotation direction by a fourth moment, the intensity in absolute value of the second moment being greater than the intensity in absolute value of the first moment for a same intensity in absolute value of the second and third moments.

4. The bracing system of claim 2 or 3, wherein, for each bracing device (22; 110; 140), the rod (86) is capable of disengaging from the nut (70) when the plate (32) is displaced in the second direction beyond a given position.

5. The bracing system of claim 4, wherein, for each bracing device (22; 110; 140), the rod (86) is capable of

cooperating again with the nut (70) after the plate (32) has been displaced in the second direction beyond the given position when the endless screw (58) is driven in the first rotation direction.

5 6. The bracing system of any of claims 1 to 5, wherein each bracing device (110; 140) comprises a part (98; 114) forming a slide joint with the rod (86).

7. The bracing system of any of claims 1 to 6, wherein the joint between the endless screw (58) and the toothed wheel
10 (70) and/or between the rod (86) and the nut (72) is an irreversible joint.

8. The bracing system of any of claims 1 to 7, wherein the torque-limiting mechanism (61) comprises a dog (62) rotated by the drive shaft (44) and comprising first teeth (66), and
15 wherein the endless screw (68) comprises, on one side, second teeth (68), complementary to the first teeth, the second teeth being capable of sliding on the first teeth in a rotation direction when the resistive torque of the endless screw is greater than a threshold.

20 9. The bracing system of claim 8, comprising a first spring (64) permanently pushing the dog (62) against the endless screw (58).

10. The bracing system of any of claims 1 to 7, wherein the wheel (70) comprises first teeth (71) cooperating with the
25 endless screw (58) and is crossed by a second opening (74) comprising second teeth (120), the nut (72) extending in the second opening, the torque-limiting mechanism (61) comprising fingers (116) radially arranged with respect to the nut, each finger comprising third teeth (119), complementary to the second
30 teeth, the third teeth being capable of sliding on the second teeth in a rotation direction when the resistive torque of the nut is greater than a threshold.

11. The bracing system of claim 10, comprising, for each finger (116), at least one second spring (126) permanently
35 pushing the finger against the second teeth (120).

12. The bracing system of any of claims 1 to 11, wherein the first opening (80) comprises a first threaded portion (82) and a second non-threaded portion (84), and the rod (86) comprises a third threaded portion (88) and a fourth non-threaded portion (89), and wherein the third threaded portion no longer meshes with the first threaded portion when the plate (32) is at closest to the nut (72).

13. The bracing system of claim 12, comprising a third spring capable of pushing on the rod (86).

10 14. The bracing system of any of claims 1 to 13, comprising a foot (30) and an alternation of first and second disks (103, 104), each first disk (103) rotating along with the foot and each second disk (104) rotating along with the nut (72), the first disks being capable of coming into contact with the second
15 disks when the plate (32) runs into an obstacle (24).

15. The bracing system (20) of any of claims 1 to 14, wherein at least two of the bracing devices (22) are coupled to each other by a rigid joint (34).

20 16. The bracing system of claim 15, wherein all the bracing devices (22) are coupled to one another by rigid joints (34).

25 17. A load bracing method (10) comprising installing the bracing system (20) of any of claims 1 to 16 between the loads and a wall (24) and simultaneously actuating the bracing devices until the plate (32) of each bracing device comes into contact with the wall (24).