SECURING DEVICE

The present patent application claims the priority benefit of French patent application FR16/61052 which is herein incorporated by reference.

Background

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

Discussion of the related art

For certain applications, it is desirable to secure 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 to prevent the loads from moving.

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 the risk of locking of the bracing device, for example, due to the corrosion of mechanical part, thus has to be low. Further, for certain applications, bracing devices may have to comply with additional constraints.

According to an example, when the loads are fragile, the installing of the bracing device may have to be performed without shocks. This for example prevents the use of wedges introduced by means of a mallet. According to another example, the congestion of the enclosure having the loads arranged therein may prevent the use of tools for installing the bracing devices, and which require space to be manipulated, for example, a mallet. According to another example, when the loads are distributed in layers stacked on one another, the bracing devices interposed between the loads of a layer should not protrude upwards from this layer to avoid interfering with the arranging of the next layer. According to another example, the visibility of the bracing devices may be low or non-existent. When the actuation of the bracing device is obtained by the cooperation of a tool, for example, an electric screwdriver, and of a mechanism of access of the bracing device, for example, a screw head, the access mechanism should remain stationary whatever the configuration of the bracing device so that an operator can always easily find the access mechanism even without seeing it.

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 only comprise mechanical parts.

Another object of an embodiment is for the height of the bracing device not to vary, whatever the configuration of the bracing device.

Another object of an embodiment is for the position of the access mechanism of the bracing device to remain constant whatever the configuration of the bracing device.

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

Thus, an embodiment provides a bracing device comprising a rod comprising a first threaded portion having a first right-hand thread and a second threaded portion having a second left-hand thread, a first nut meshing with the first thread, a second nut meshing with the second thread, and at least first and second jaws each in slide joint connection with the first and second nuts.

According to an embodiment, the ratio of the height of each first and second jaw, measured along the axis of the rod, to the maximum transverse direction, when the jaws are the closest to each other, is in the range from 2 to 10.

According to an embodiment, the rod comprises, at one end, a head intended to be actuated by a tool.

According to an embodiment, the first nut comprises first and second opposite sides inclined with respect to the axis of the rod, the inclination angles of the first and second sides being opposite, the second nut comprising third and fourth opposite sides inclined with respect to the axis of the rod, the inclination angles of the third and fourth sides being opposite, the first jaw comprising first and second walls, the first side being capable of sliding on the first wall and the third side being capable of sliding on the second wall, and the second jaw comprising third and fourth walls, the second side being capable of sliding on the third wall and the fourth side being capable of sliding on the fourth wall.

According to an embodiment, the device comprises:

a first pin coupled to the first nut, at least one end of the first pin sliding in a first groove of the first jaw extending parallel to the first wall;

a second pin coupled to the first nut, at least one end of the second pin sliding in a second groove of the second jaw and extending parallel to the third wall;

a third pin coupled to the second nut, at least one end of the third pin sliding in a third groove of the first jaw and extending parallel to the second wall; and

a fourth pin coupled to the second nut, at least one end of the fourth pin sliding in a fourth groove of the second jaw and extending parallel to the fourth wall.

According to an embodiment, the device comprises at least one pin, having an axis perpendicular to the axis of the rod, affixed to the first jaw or to the second jaw, the rod comprising a recess between the first threaded portion and the second threaded portion, the pin being tangent to the rod in the recess.

According to an embodiment, the device comprises at least one stop between the first and second nuts.

According to an embodiment, the device comprises a resilient element surrounding the first and second jaws.

According to an embodiment, the first and second nuts are identical.

According to an embodiment, the pitch of the first right-hand thread is different from the pitch of the second left-hand thread.

Another embodiment also provides a load bracing method comprising the steps of:

arranging bracing devices such as previously defined between loads of a first layer of loads;

actuating the bracing devices to secure the loads; and

forming a second layer of loads on the first layer.

Brief description of the drawings

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:

Figure 1 is a partial simplified top view of an assembly of loads held by bracing devices;

Figure 2 is a partial simplified cross-section top view of Figure 1;

Figure 3 is a perspective view of an embodiment of a bracing device;

Figure 4 is an exploded view of the bracing device shown in Figure 3;

Figures 5, 6, and 7 are cross-section views of the bracing device shown in Figure 3 respectively along lines V-V, VI-VI, and VII-VII;

Figures 8 and 9 are top views of the bracing device shown in Figure 3 in two different configurations of use;

Figures 10 to 12 are perspective views of other embodiments of the bracing device;

Figure 13 is a perspective view of the bracing device shown in Figure 12, where certain parts of the bracing device are not shown;

Figure 14 is a cross-section view of another embodiment of the bracing device;

Figures 15 to 17 are partial simplified cross-section views of other embodiments of the bracing device;

Figure 18 is a simplified cross-section view of an embodiment of an anti-rotation device; and

Figures 19A to 19C are partial simplified perspective views of the bracing device shown in Figure 3 at successive steps of a method of locking the bracing device against any loosening.

Detailed description

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 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%, preferably of plus or minus 5%, of the value in question.

Figure 1 is a partial simplified side view of an assembly of loads 10 arranged in an enclosure 12 delimited by a frame 14 and distributed in substantially horizontal layers 16 stacked on one another, each layer 16 comprising loads 10 arranged next to one another. As an example, five layers 16 are shown in Figure 1. Loads 10 for example correspond to boxes, containers, or accumulator batteries. Bracing devices 20 are interposed, for each layer 16, between loads 10 of layer 16 to prevent displacements of loads 10.

Figure 2 is a cross-section top view of Figure 1 along line II-II. As an example, in Figure 2, two bracing devices 20 interposed between two adjacent loads 10 have been shown. Each bracing device 20, when actuated, tends to draw the two loads 10 away from each other.

Figures 3 to 7 show a more detailed embodiment of bracing device 20 comprising:

a rod 22 of axis D comprising a first threaded portion 24 having a left-hand thread and a second threaded portion 26 having a right-hand thread, threaded portions 24, 26 being separated by a recess 28 located substantially in the median portion of rod 22, rod 22 further comprising an actuation head 30;

a first nut 32, comprising a threaded opening 34 cooperating with threaded portion 24, the first nut 32 further comprising opposite sides 36, 38 inclined with respect to axis D, the inclination angles of sides 36, 38 being opposite, sides 36, 38 coming closer to each other as the distance to head 30 along axis D increases;

a second nut 40, comprising a threaded opening 42 cooperating with threaded portion 26, the second nut 40 further comprising opposite sides 44, 46 inclined with respect to axis D, the inclination angles of sides 44, 46 being opposite, sides

44, 46 coming closer to each other as the distance to head 30 along axis D decreases;

a first jaw 48 which extends substantially along the entire height of rod 22, possibly except for actuation head 30, jaw 48 comprising, on the side of rod 22, a cavity 47 extending along the entire height of jaw 48, cavity 47 being delimited by two parallel lateral walls 49 and by successive bottom walls 50, 51, 52 perpendicular to lateral walls 49, bottom wall 50 being for example a planar wall inclined with respect to axis D, having the inclined side 36 of nut 32 sliding thereon, bottom wall 51, shown in Figure 5, extending between bottom walls 50 and 52 and being parallel to axis D, and bottom wall 52, shown in Figure 5, being for example a planar wall inclined with respect to axis D, having inclined side 44 of nut 40 sliding thereon, the inclinations of bottom walls 50, 52 being equal in absolute value and having opposite signs;

a second jaw 54 which extends substantially along the entire height of rod 22, possibly except for actuation head 30, jaw 54 comprising, on the side of rod 22, a cavity 53 extending along the entire height of jaw 54, cavity 53 being delimited by two parallel lateral walls 55 and by successive bottom walls 56, 57, 58 perpendicular to lateral walls 55, bottom wall 56 being for example a planar wall inclined with respect to axis D, having the inclined side 38 of nut 32 sliding thereon, bottom wall 57 extending between bottom walls 56 and 58 and being parallel to axis D, and bottom wall 58 being for example a planar wall inclined with respect to axis D, having inclined side 46 of nut 40 sliding thereon, the inclinations of bottom walls 56, 58 being equal in absolute value and having opposite signs;

a first guide pin 60, for example having a cylindrical shape with an axis perpendicular to axis D, housed in an opening 62 crossing nut 32, pin 60 extending on either side of nut 32, the ends of pin 60 sliding in grooves 64, shown in Figures 4 and 5, provided in jaw 48 and extending parallel to bottom wall 50;

a second guide pin 66, for example having a cylindrical shape with an axis perpendicular to axis D, housed in an opening 68 crossing nut 32, pin 66 extending on either side of nut 32, the ends of pin 66 sliding in grooves 70 provided in jaw 54 and extending parallel to bottom wall 56;

a third guide pin 72, for example having a cylindrical shape with an axis perpendicular to axis D, housed in an opening 74 crossing nut 40, pin 72 extending on either side of nut 40, the ends of pin 72 sliding in grooves 76, shown in Figure 5, provided in jaw 48 and extending parallel to bottom wall 52;

a fourth guide pin 78, for example having a cylindrical shape with an axis perpendicular to axis D, housed in an opening 80 crossing nut 40, pin 78 extending on either side of nut 40, the ends of pin 78 sliding in grooves 82 provided in jaw 54 and extending parallel to bottom wall 58;

a first alignment pin 84 having an axis perpendicular to axis D, comprising a threaded portion 86, shown in Figure 7, cooperating with a non-through threaded opening 88 of jaw 54, threaded portion 86 being continued by a first cylindrical portion 90 housed in a through cylindrical opening 92 of jaw 48, pin 84 being tangent to rod 22 in recess 28; and

a second alignment pin 94 having an axis perpendicular to axis D, comprising a threaded portion 96, shown in Figure 7, cooperating with a non-through threaded opening 98 of jaw 48, threaded portion 96 being continued by a cylindrical portion 100 housed in a through cylindrical opening 102 of jaw 54, axis 94 being tangent to rod 22 in recess 28.

In the embodiment shown in Figures 3 to 7, the heights of nuts 32, 40 measured along axis D are equal. Further, the inclination angles of sides 36, 38, 44, 46 with respect to axis D are equal in absolute value and equal in absolute value to the inclination angles of walls 50, 52, 56, 58. As will be described hereafter, for assembly purposes, jaw 48 comprises aligned through openings 104, perpendicular to axis D, at one end of grooves 64 and aligned through openings 106, perpendicular to

axis D, at one end of grooves 76. Further, jaw 54 comprises aligned through openings 108, perpendicular to axis D, at one end of grooves 70 and aligned through openings 110, perpendicular to axis D, at one end of grooves 82.

The operation of bracing device 20 will now be described in relation with Figures 8 and 9. In the drawings, a layer 112 of a resilient material, for example, an elastomer, surrounds the two jaws 48 and 54. As a variation, layer 112 may be replaced with plates of a resilient material affixed on the external surfaces of jaws 48, 54.

Rod 22 may be rotated around its axis D by a tool, not shown, cooperating with head 30, for example, a mechanical screwdriver or an electric screwdriver fitted with a bushing having a shape complementary to that of head 30. The rotation of rod 22 causes the displacement of each nut 32, 40 along axis D in opposite directions by cooperation of threaded portion 24 with threaded opening 34 of nut 32 and by cooperation of threaded portion 26 with threaded opening 42 of nut 40. The rotating of rod 22 in one direction results in drawing nuts 32, 40 away from each other and the rotating of rod 22 in the opposite direction results in bringing nuts 32, 40 towards each other. The fact of bringing nuts 32, 40 towards each other results in drawing jaws 48, 54 away from each other along direction E, for example, perpendicular to axis D, by cooperation of sides 36, 38 of nut 32 with bottom walls 50, 56 of jaws 48, 54 and by cooperation of sides 44, 46 of nut 40 with bottom walls 52, 58 of jaws 48, 54. The drawing of nuts 32, 30 away from each other brings jaws 48, 54 towards each other along direction E by cooperation of guide pins 60, 66 of nut 32 with grooves 64, 70 of jaws 48, 54 and by cooperation of guide pins 72, 78 of nut 40 with grooves 76, 82 of jaws 48, 54. Pins 84, 94 prevent a relative displacement along axis D of jaw 48 with respect to jaw 54 and maintain a ball joint between rod 22 and jaws 48, 54.

The pitch of threaded portions 24, 26 of rod 22 and the inclination angles of walls 50, 52, 56, 58 are selected so that bracing device 20 is not a reversible mechanical system, that is, an action of jaws 48, 54 cannot cause the displacement of nuts 32, 40 and the rotating of rod 22. Thereby, in the absence of an actuation of head 30 of rod 22, bracing device 20 remains locked.

Bracing device 20 is initially in a so-called closed configuration where jaws 48, 54 are the closest to each other, preferably in contact with each other as shown in Figures 3 and 8. According to an embodiment, in the closed configuration, the ratio of height H of jaws 48, 54 measured along axis D to the maximum transverse dimension T of bracing device 20 in the closed configuration is in the range from 2 to 10, preferably from 5 to 10. Bracing device 20 is then introduced into a housing 114 delimited by two adjacent loads 10 and having a shape substantially complementary to that of jaws 48, 54. As an example, as shown in Figure 8, housing 114 has, in a plane perpendicular to axis D, a cross-section of generally hexagonal shape, and each jaw 48, 54 has an outer wall, opposite to rod 22, which, in a plane perpendicular to axis D, has the shape of a half-hexagon. Rod 22 is then rotated by the cooperation of a tool with head 30 to cause the spacing apart of jaws 48, 54 from each other until resilient layer 112 comes into contact with loads 10. The actuation of rod 22 is then interrupted. Bracing device 20 being a non-reversible mechanical system, it remains locked in this configuration. The bracing function is thus obtained. The removal of bracing device 20 is performed by rotating rod 22 by the cooperation of a tool with head 30 to draw jaws 48, 54 towards each other. Layer 112 is then no longer in contact with loads 10 and bracing device 20 can be removed. Bracing device 20 can be reused as many times as necessary.

The intensity of the load exerted by jaws 48, 54 on loads 10 may be accurately adjusted by an actuation of rod 22. The application of the bracing load may be progressive, which

enables not to damage loads 10. The distribution of the load exerted by jaws 48, 54 on loads 10 particularly depends on the dimensions of nuts 32, 40. During the actuation of bracing device 20, the total height of bracing device 20 is constant and equal to height H of jaws 48, 54. This enables to simply use device 20 to secure loads 10 distributed in stacked layers, given that when bracing device 20 does not protrude upwards from the loads 10 between which it is arranged in closed configuration, it does not protrude upwards from loads 10 whatever the spacing between jaws 48, 54. During the actuation of bracing device 20, there is no displacement of rod 22 along axis D. The position of head 30 along axis D is thus stationary. This enables to easily reach head 30 and to actuate bracing device 20 even if it is not visible.

An embodiment of the assembly of bracing device 20 is the following:

nuts 32, 40 are screwed to rod 22 to be the closest to each other along axis D;

jaws 48, 54 are then placed against each other, openings 104, 106, 108, and 110 of jaws 48, 54 being then respectively in line with openings 62, 74, 68, 80 of nuts 32, 40;

guide pin 60 is introduced into openings 104 and 62, guide pin 66 is introduced into openings 108 and 68, guide pin 72 is introduced into openings 106 and 74, and guide pin 78 is introduced into openings 110 and 80;

rod 22 is actuated to draw jaws 48, 54 away from each other along axis D, openings 104, 106, 108, and 110 of jaws 48, 54 being no longer respectively aligned with openings 62, 74, 68, 80 of nuts 32, 40, guide pins 60, 66, 72, and 78 cannot escape from bracing device 20; and

pin 84 is introduced into opening 92 of jaw 48 and screwed to jaw 54, and pin 94 is introduced into opening 102 of jaw 54 and screwed to jaw 48.

An embodiment of the disassembly of bracing device 20 is the following:

pins 84 and 94 are unscrewed and removed;

rod 22 is actuated to bring jaws 48, 54 as much as possible towards each other along axis D; and

openings 104, 106, 108, and 110 of jaws 48, 54 then respectively being in line with openings 62, 74, 68, 80 of nuts 32, 40, guide pins 60, 66, 72, 78 can then be removed.

According to an embodiment, jaws 48 and 54 are identical parts and nuts 32, 40 are identical parts except for the threads, which are opposite, one of the nuts having a right-hand thread and the other nut having a left-hand thread. This enables to decrease the manufacturing cost of bracing device 20.

Figure 10 is a perspective cross-section view of another embodiment of a bracing device 120. Bracing device 120 comprises all the elements of bracing device 20, with the difference that layer 112 is replaced with plates 122 of a resilient material affixed to the outer surfaces of each jaw 48, 54 and that rod 22 comprises a non-threaded portion 124 between threaded portions 24 and 26, recess 28 being substantially located in the middle of non-threaded portion 124. Bracing device 120 further comprises a stop 126, for example, ring-shaped, arranged between nut 32 and pins 84, 94, not shown in Figure 10, and comprises a stop 128, for example ring-shaped, arranged between nut 40 and pins 84, 94. Stops 126, 128 enable to limit the travel of each nut 32, 40 to the desired value. In the present embodiment, stops 126, 128 have the same length measured along axis D.

According to an embodiment, when a plurality of bracing devices are used to secure an assembly of loads 10, most bracing devices may correspond to bracing device 120. This provides the desired spacings between loads 10. A row of bracing devices corresponding to bracing device 20 shown in Figures 3 to 7 is used to homogeneously secure all loads 10.

Figure 11 is a perspective view of another embodiment of a bracing device 130. Bracing device 130 comprises all the elements of bracing device 20, with the difference that guide pins 60, 66, 72, 78 and grooves 64, 70, 76, 82 are not present. Resilient elements, for example, resilient cords 132 may be provided around jaws 48, 54. They enable to bring jaws 48, 54 towards each other when nuts 32, 40 are taken back to the closed configuration.

Figures 12 and 13 are perspective views of another embodiment of a bracing device 140, jaw 54 not being shown in Figure 13. Bracing device 140 comprises all the elements of bracing device 20, with the difference that pins 84, 94 and recess 28 are not present, that guide pin 60 is replaced with protruding edges 142 of nut 32 which cooperate with grooves 64 of jaw 48, that guide pin 66 is replaced with protruding edges 144 of nut 32 which cooperate with grooves 70 of jaw 54, that guide pin 72 is replaced with protruding edges, not shown in Figures 12 and 13, of nut 40 which cooperate with grooves 76 of jaw 48, and that guide pin 78 is replaced with protruding edges 148 of nut 40 which cooperate with the grooves, not shown in Figures 12 and 13, of jaw 54. Further, each jaw 48, 54 comprises protruding pads 150 capable of penetrating into openings 152 provided on the other jaw 48, 54 when the two jaws 48, 54 are in contact with each other to play the role of pins 84, 94. Bracing device 140 further comprises screws 154 screwed into through threaded openings 156 provided in jaws 48, 54, the ends of screws 154 cooperating with grooves 158 provided in nuts 32, 40. Screws 154 are used as stops to the displacements of nuts 32, 40.

In the present embodiment, each jaw 48, 54 comprises a central recess 160 having grooves 64, 70, 76, 82 emerging onto it. Central recess 160 is used on assembly of bracing device 140, nuts 32, 40 being assembled on rod 22 and brought into contact with each other and jaws 48, 54 being brought into contact with each other, so that nuts 32, 40 are located in

central recesses 160. Rod 22 is then rotated to have each nut 32, 40 penetrate into grooves 64, 70, 76, 82. When nuts 32, 40 are sufficiently distant from each other, screws 154 may be installed.

Figure 14 is a cross-section view of another embodiment of a bracing device 170. Bracing device 170 comprises all the elements of bracing device 20, with the difference that height h1, measured along axis D, of nut 32 is not equal to height h2, measured along axis D, of nut 40 and that the inclination angles, in absolute value, of sides 36, 38 of nut 32 with respect to axis D are different from the inclination angles, in absolute value, of sides 36 of nut 40 with respect to axis D. The pitch of the right-hand threads of rod 22 is different from the pitch of the left-hand threads of rod 22 to allow a simultaneous displacement of nuts 32, 40. More particularly, the ratio of the tangents of the half-angles at the top of nuts 32, 40 is proportional to the ratio of the left- and and right-hand pitches. Bracing device 170 enables to asymmetrically distribute the stress exerted by jaws 48, 54 on loads 10.

Further, in the present embodiment, for each pair of cylindrical openings 104, 106, 108, and 110, one of the openings has a diameter smaller than the diameter of the other opening. Advantageously, on assembly of bracing device 170, when guide pin 60, 72, 68, 78 is inserted into the associated opening 104, 106, 108, and 110 of larger diameter, it cannot escape on the other side of jaw 48, 54 through the opening of smallest diameter. Further, on assembly of bracing device 170, it is possible to push guide pin 60, 72, 68, 78 out of the opening 104, 106, 108, and 110 of largest diameter by introducing a push element through the opening 104, 106, 108, and 110 of smallest diameter.

Figure 15 is a cross-section view of the rod 22 and of the nuts 32, 40 of another embodiment of bracing device 174. Unlike bracing device 20 shown in Figures 3 to 7, sides 36, 38

of the nut move away from each other as the distance to head 30 along axis D increases and sides 44, 46 of nut 40 move away from each other as the distance to head 30 along axis D decreases. In this embodiment, when rod 22 is rotated, a drawing of nuts 32, 40 away from each other causes a drawing of the jaws away from each other, and a bringing of nuts 32, 40 towards each other causes a bringing of jaws 48, 54 towards each other.

Figure 16 is a cross-section view of rod 22 and of the nuts of another embodiment of bracing device 176. In addition to nuts 32, 40, the bracing device comprises an additional nut 178 screwed to threaded portion 24 of rod 22. More generally, the number of nuts screwed to rod 22 is selected according to the desired distribution of the load to be exerted by jaws 48, 54 on loads 10.

Further, even if only two jaws 48, 54 are used in the previously-described embodiments, the number of jaws may be greater than two.

Figure 17 is a cross-section view in a plane perpendicular to axis D of a bracing device 180, only the jaws and rod 22 being shown. As an example, four jaws 182, 184, 186, 188 may be used, forming a first pair of opposite jaws 182, 184 and a second pair of opposite jaws 186, 188. In closed configuration, the outer surfaces of jaws 182, 184, 186, 188 may form a square in top view. When rod 22 is actuated, jaws 182, 184 of the first pair displace along a first direction E1 perpendicular to axis D, away from or towards each other along the rotation direction of rod 22, and jaws 186, 188 of the second pair displace along a second direction E2 perpendicular to axis D and perpendicular to the first direction E1 away from or towards each other according to the rotation direction of rod 22.

Figure 18 is a simplified cross-section view of an embodiment of an anti-rotation device 200 and Figures 19A to 19C are partial simplified perspective views of bracing device 20 shown in Figure 3 at successive steps of a method of locking

bracing device 20 against loosening using anti-rotation device 200.

According to an embodiment, anti-rotation device 200 comprises a base 202 and a head 204. As shown in Figure 19B, head 204 has, in top view,, a circular cross-section of axis A. Base 202 has, in top view, a square external cross-section with beveled edges, having its center on axis A. Anti-rotation device 200 is thoroughly crossed by an opening 206 of axis A comprising a first portion 208, on the side of base 202, continued by a second portion 210 on the side of head 204. Portion 208 of opening 206 has a circular cross-section with a diameter slightly greater than the external diameter of rod 22. Portion 210 of opening 206 comprises teeth 212 extending parallel to axis A.

An embodiment of a method of locking bracing device 20 will now be described. Bracing device 20 is taken to its position of use by rotating rod 22 (Figure 19A). Anti-rotation device 200 is taken opposite head 30 (Figure 19B). Anti-rotation device 200 is then inserted on head 30 (Figure 19C) so that base 202 is located between jaws 48, 54 and head 30 is at least partly located in portion 210 of opening 206. Head 30 then cooperates with teeth 212. Base 202 prevents any rotating motion of anti-rotation device 200 with respect to bracing device 20 abutting against jaws 48, 54. A rotating motion of head 22 corresponding to a loosening is thus prevented, where the loosening may be due to an action of an operator or may be unintentional, for example, due to vibrations or to the load exerted on bracing device 20. Indeed, rod 22 and anti-rotation device 200 rotate along with each other by the cooperation of head 30 and of teeth 212 and any rotating motion of anti-rotation device 200 is prevented by the abutting of base 202 against jaws 48, 54.

Various embodiments with various variations have been described hereabove. It should be noted that those skilled in the art may combine these various embodiments and variations

without showing any inventive step. In particular, the use of pairs of openings 104, 108, 106, 110 of different diameters previously described for bracing device 170 in relation with Figure 14 may be implemented with the other previously-described embodiments, particularly bracing devices 20, 120, 130, 174, 176, and 180.

CLAIMS

1. A bracing device comprising a rod comprising a first threaded portion having a first right-hand thread and a second threaded portion having a second left-hand thread, a first nut meshing with the first thread, a second nut meshing with the second thread, and at least first and second jaws each in slide joint connection with the first and second nuts.

2. The bracing device of claim 1, wherein the ratio of the height of each first and second jaw measured along the axis (D) of the rod, to the maximum transverse dimension, when the jaws are the closest to each other, is in the range from 2 to 10.

3. The bracing device of claim 1 or 2, wherein the rod comprises, at one end, a head intended to be actuated by a tool.

4. The bracing device of any of claims 1 to 3, wherein the first nut comprises first and second opposite sides inclined with respect to the axis (D) of the rod, the inclination angles of the first and second sides being opposite, wherein the second nut comprises third and fourth opposite sides inclined with respect to the axis of the rod, the inclination angles of the third and fourth sides being opposite, wherein the first jaw comprises first and second walls, the first side being capable of sliding on the first wall and the third side being capable of sliding on the second wall, and wherein the second jaw comprises third and fourth walls, the second side being capable of sliding on the third wall and the fourth side being capable of sliding on the fourth wall.

5. The bracing device of claim 4, comprising:

a first pin coupled to the first nut, at least one end of the first pin sliding in a first groove of the first jaw extending parallel to the first wall;

a second pin coupled to the first nut, at least one end of the second pin sliding in a second groove of the second jaw and extending parallel to the third wall;

a third pin coupled to the second nut, at least one end of the third pin sliding in a third groove of the first jaw and extending parallel to the second wall; and

a fourth pin coupled to the second nut, at least one end of the fourth pin sliding in a fourth groove of the second jaw and extending parallel to the fourth wall.

6. The bracing device of any of claims 1 to 5, comprising at least one pin, having an axis perpendicular to the axis (D) of the rod, affixed to the first jaw or to the second jaw, the rod comprising a recess between the first threaded portion and the second threaded portion, the pin being tangent to the rod in the recess.

7. The bracing device of any of claims 1 to 6, comprising at least one stop between the first and second nuts.

8. The bracing device of any of claims 1 to 7, comprising a resilient element surrounding the first and second jaws.

9. The bracing device of any of claims 1 to 8, wherein the first and second nuts are identical.

10. The bracing device of any of claims 1 to 9, wherein the pitch of the first right-and thread is different from the pitch of the second left-hand thread.

11. A method of bracing loads comprising the steps of:

arranging bracing devices of any of claims 1 to 10 between loads of a first layer of loads;

actuating the bracing devices to secure the loads; and

forming a second layer of loads on the first layer.