

A RETROFIT DEVICE FOR A LADDER

Technical Field

- 5 The present disclosure generally relates to a retrofit device for a ladder. More particularly, the present disclosure describes various embodiments of a retrofit device for stabilizing the ladder having at least two frames supported on a ground.

Background

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Ladders are often used in industrial factories to allow access to high areas. These ladders could come in the form of A-frame ladders with four frames or legs supported on the ground, such that the ladder forms an A-shaped or inverted V-shaped side profile. These ladders could also come in the form of a two-frame ladder supported
15 on the ground. The opposite end of the two-frame ladder would rest against a wall for stability. One problem with such ladders is that they can be quite unstable for the user, especially when the user is standing on the higher or upper steps. The present types of ladders typically only have four points of contact with a fixed body – the A-frame ladder has four contact points on the ground, and the two-frame ladder has
20 two contact points on the ground and two contact points on the wall. These are safety concerns that the user should be aware of, especially in instance where the ladders are used by construction workers in factories and for maintenance purposes.

One possible solution for companies that use such ladders in factories is to place
25 additional workers to manually support the ladders. For example, if an A-frame ladder is to be used to gain access to upper areas, in addition to one work on the top platform of the ladder, additional one or two workers can be placed on the ground to help support the ladder. This would improve safety as the additional can hold on to the ladder to add stability thereto. However, the role of the additional workers is
30 merely to hold on to and support the ladder. From the workers' perspective, this is time wasted as they can be in another part of the factory doing other work. From the company's perspective, this represents additional costs in terms of labour hours.

Thus, although the use of additional workers may address some safety concerns of existing ladders, their use would lead to higher costs for companies.

Another possible solution is to use supporting devices or reinforcement structures.

- 5 An example of such a reinforcement structure is disclosed in United States patent number 8,424,642. The structure disclosed in US 8,424,642 comprises a telescopic body with adjustable ends. One end of the structure is affixed to a frame of the ladder, such as an A-frame ladder, and the other end is placed on the ground. Thus, the reinforcement structure provides an additional frame or leg to the ladder.
- 10 However, as the reinforcement structure is only attached to one frame of the ladder, the stability of the ladder would not be greatly improved. If multiple such structures are used, it would be costlier for companies to implement.

- Therefore, in order to address at least one of the aforementioned problems and/or
- 15 disadvantages, there is a need to provide a retrofit device for a ladder, in which there are improved features compared to the aforementioned prior art.

Summary

- 20 According to an aspect of the present disclosure, there is provided a retrofit device for stabilizing a ladder having at least two frames supported on a ground. The retrofit device comprises an elongated structure for providing an additional support on the ground for the ladder. The retrofit device further comprises a brace structure coupled to the elongated structure, the brace structure having a left portion and a right portion.
- 25 The left portion is attachable to one frame of the ladder and the right portion is attachable to another frame of the ladder. The brace structure rigidly maintains a distance between the one frame and the other frame of the ladder.

- An advantage of the retrofit device of the present disclosure is that it provides an
- 30 additional contact point of support on the ground for the ladder, including A-frame ladders and typical two-frame ladders. Additionally, the retrofit device is secured onto two frames of the ladder, such that it rigidly maintains the distance between the two frames. This advantageously mitigates the risks of the two frames accidentally

coming together, particularly for A-frame ladders whereby the pivot may give way and the frames or legs of the ladder would suddenly close, especially during accidental kicks on the ladder. Therefore, the retrofit device of the present disclosure is advantageous in reinforcing the stability and improving the safety of ladders.

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Preferably, at least one of the elongated structure and the brace structure is extendable. The elongated structure preferably comprises an external portion and an internal portion telescopically arranged for moving relative to each other. The elongated structure preferably comprises a plurality of locations, each location
10 determining an overall length of the elongated structure. More preferably, the external portion and the internal portion are lockable at each of the plurality of locations; and the brace structure is lockable with respect to the elongated structure. The ability for the elongated structure and/or the brace structure to move telescopically for extension and retraction allows the user to use the retrofit devices
15 on different ladders of different heights and sizes.

The retrofit device preferably comprises a base bracket pivotally coupled to the elongated structure, wherein the base bracket provides the additional support on the ground. More preferably, the base bracket is lockable with respect to the elongated
20 structure. The base bracket can be rotated and locked such that the retrofit device can be used on non-flat or undulating grounds.

Each of the left portion and the right portion of the brace structure preferably comprises a brace bracket rotatably coupled to the brace structure. More preferably,
25 each brace bracket is lockable with respect to the brace structure. The angle of each brace bracket can thus be adjusted to accommodate different types and models of the ladders.

Preferably, the retrofit device comprises a fastening mechanism for tightening each
30 brace bracket on the ladder. The brace brackets on the left and right portions of the brace structure can be adjusted to different angles and the fastening mechanism allows for such adjustment and the locking of the brace brackets at the desired angles.

Preferably, the retrofit device comprises a ground pad attachable to the base bracket, wherein the ground pad supports the ladder on the ground. The ground pad provides the retrofit device with a stable ground support because of frictional properties of the ground pad with respect to the ground, thereby mitigating the risk of the retrofit device slipping when used with the ladder.

A retrofit device for a ladder according to the present disclosure is thus disclosed hereinabove. Various features, aspects, and advantages of the present disclosure will become more apparent from the following detailed description of the embodiments of the present disclosure, by way of non-limiting examples only, along with the accompanying drawings in which like numerals represent like components.

Brief Description of the Drawings

FIG. 1 is an isometric view of a configuration of a ladder with a retrofit device for the ladder, according to an embodiment of the present disclosure.

FIG. 2 is a side view of the configuration in FIG. 1, according to an embodiment of the present disclosure.

FIG. 3 is a front view of the configuration in FIG. 1, according to an embodiment of the present disclosure.

FIG. 4 is an isometric view of the retrofit device, according to an embodiment of the present disclosure.

FIG. 5 is a partially exploded front view of the retrofit device, according to an embodiment of the present disclosure.

FIG. 6 is an isometric view of a lower end of the retrofit device, according to an embodiment of the present disclosure.

FIG. 7 is a side view of a base bracket for the retrofit device, according to an embodiment of the present disclosure.

5 FIG. 8 is a front view of the base bracket, according to an embodiment of the present disclosure.

FIG. 9 is an exploded isometric view of the base bracket, according to an embodiment of the present disclosure.

10 FIG. 10 is a partially exploded isometric view of a brace structure for the retrofit device, according to an embodiment of the present disclosure.

FIG. 11 is a top view of the brace structure, according to an embodiment of the present disclosure.

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Detailed Description

For purposes of brevity and clarity, descriptions of embodiments of the present disclosure are limited hereinafter to a retrofit device for a ladder, in accordance with the drawings in FIG. 1 to FIG. 11. Unless explicitly stated otherwise, in the description herein the recitation of particular numerical values or value ranges is taken to be a recitation of particular approximate numerical values or approximate value ranges. Various embodiments of the present disclosure are directed toward structural and functional aspects of the retrofit device for a ladder. While aspects of the present disclosure will be described in conjunction with the embodiments provided herein, it will be understood that they are not intended to limit the present disclosure to these embodiments. On the contrary, the present disclosure is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the present disclosure as defined by the appended claims. Furthermore, in the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. However, it will be recognized by an individual having ordinary skill in the art, i.e. a skilled person, that the present disclosure may be practiced without these specific

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details. In other instances, well-known systems, methods, procedures, and components have not been described in detail as not to unnecessarily obscure aspects of the embodiments of the present disclosure.

- 5 In a preferred embodiment of the present disclosure, a retrofit device 100 for a ladder 200 is described hereinafter.

FIG. 1 to FIG. 3 show diagrams of two retrofit devices 100 being used on an A-frame ladder 200. The ladder 200 comprises two pairs of frames or legs 202, i.e. a total of
10 four frames 202, which are supported on the ground, thereby giving a four-point contact to the ladder 200. The ladder 200 further comprises a plurality of steps 204 for a user to climb on, and a top platform 206 for the user to work on. Each of the two pairs of frames 202 is connected by a linkage 208, such that each pair of frames 202 forms an A-shaped or inverted V-shaped side profile. Each of the frames 202 are
15 pivoted around a pivot area 210 near the top platform 206, such that the frames 202 are foldable to compact the ladder 200 into a rectangular profile. When the ladder 200 is open, the A-shaped or inverted V-shaped side profile is such that the frames 202 form an angle 212 around the pivot area 210. Because of the separation caused by the angle 212, each frame 202 in a pair is separated by a distance 214. The
20 separation distance 214 varies along the frame 202 from its top portion to its bottom portion. For example, the separation distance 214 near the top portion of the frame 202 is shorter as compared to the separation distance 214 near the bottom portion of the frame 202, as shown in FIG. 2. As with typical industrial ladders, the retrofit device 100 and the ladder 200 are made from a lightweight aluminium material.
25 However, other materials known to the skilled person may also be used for the retrofit device 100 and the ladder 200.

Looking at the isometric profile, side profile, and front profile of the ladder 200 in FIG. 1 to FIG. 3, respectively, the retrofit devices 100 are positioned on the left and right
30 sides of the ladder 200, particularly on the four frames 202. The top portions of the retrofit devices 100 are affixed or attached to the frames 202 and the bottom portions of the retrofit devices 100 are supported on the ground. Therefore, the combination of the two retrofit devices 100 with the ladder 200 provides a six-point contact to the

ladder 200, thereby reinforcing and improving the stability of the ladder 200. In the preferred embodiment, the position of the retrofit devices 100 with respect to the ladder 200 is such that the angle 216 formed between the retrofit devices 100 and the vertical is 30°.

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Referring to FIG. 4, the retrofit device 100 comprises an elongated structure 102 having a tubular or cylindrical profile. The elongated structure 102 has an upper end 104 and the elongated structure 102 is coupled to a brace structure 106, particularly at the upper end 104. The brace structure 106 is attachable to the frames 202 of the ladder 200 to provide reinforcement support and to improve the stability of the ladder 200. Referring also to FIG. 5, the elongated structure 102 in the preferred embodiment is extendable. Specifically, the elongated structure 102 comprises an internal tubular structure 108 and an external tubular structure 110. The internal tubular structure 108 is disposed or nested within the external tubular structure 110, such that the internal tubular structure 108 and the external tubular structure 110 are telescopically arranged with respect to each other. The internal tubular structure 108 and the external tubular structure 110 are thus moveable relative to each other for extending and retracting the elongated structure 102. Additionally, the elongated structure 102 comprises a plurality of holes 112. Specifically, each of the tubular structures 108 and 110 comprises the plurality of holes 112. The plurality of holes 112 can be aligned during the telescopic extension and/or retraction of the external tubular structure 110 in order to obtain different overall lengths of the elongated structure 102. For example, the alignment of the holes 112a would give the maximum overall length of the elongated structure 102. The locking of the aligned holes 112 may be done by putting a pin or shaft through the holes aligned holes 112. The pin or shaft may be attached or chained to the elongated structure 102 to prevent it from getting lost. Other means of locking, such as latches and clips, known to the skilled person may also be used. It would be apparent to the skilled person that other means of making the elongated structure 102 telescopically extendable are possible, such as the use of screw threads.

The ability for the elongated structure 102 to telescopically extend and retract allows the user to use the retrofit devices 100 on different ladders 200 of different heights

and sizes. As such, companies do not need to purchase so many retrofit devices 100 to suit all of their ladders 200. Alternatively, the elongated structure 102 may be fully fixed and not extendable, such that the structural integrity of the retrofit device 100 is better, especially because the risk of the aligned holes 112 being unlocked accidentally is mitigated.

The telescopic arrangement in the preferred embodiment is such that the internal tubular structure 108 is disposed near the upper end 104 of the elongated structure 102, and the external tubular structure 110 is disposed near a lower end 114 of the elongated structure 102. Thus, the upper end 104 belongs to the internal tubular structure 108 and the lower end 114 belongs to the external tubular structure 110. In an alternative embodiment, the positions may swap, while maintaining a similar telescopic arrangement, such that the upper end 104 belongs to the external tubular structure 110 and the lower end 114 belongs to the internal tubular structure 108.

In the preferred embodiment as shown in FIG. 5 and FIG. 6, the elongated structure 102, particularly at the lower end 114 of the external tubular structure 110, is coupled to a base bracket 116. Referring also to FIG. 7 to FIG. 9, the base bracket 116 comprises a U-shaped bracket having a bottom side 118 and two sides 120, each of the two sides 120 having a threaded hole 122. The base bracket 116 is pivotally coupled to the lower end 114 via a set screw 124 that passes through lower end 114 and the threaded holes 122 of the sides 120. The set screw 124 allows the base bracket 116 to rotate with respect to the elongated structure 102, such that the retrofit device 100 can be used on non-flat grounds. The base bracket 116 can be locked at a desired angle with the use of screw nuts 126. The screw nuts 126 can be screwed onto the set screw 124 and tightened against the sides 120. Other means of locking the base bracket 116 known to the skilled person may also be used. Additionally, the base bracket 116 comprises a rubber pad 128 attached, e.g. by an adhesive, to the bottom side 118. The rubber pad 128 provides the retrofit device 100 with a stable ground support because of the frictional properties of the rubber pad 128 with respect to the ground, thereby mitigating the risk of the retrofit device 100 slipping when used with the ladder 200.

FIG. 10 shows the brace structure 106 that is coupled to the elongated structure 102, particularly at the upper end 104 of the internal tubular structure 108. The brace structure 106 comprises a rectangular plate 130 and a centre bracket 132. The brace structure 106 further comprises a left bracket 134 at a left portion of the brace structure 106, and a right bracket 136 at a right portion of the brace structure 106.

Referring also to FIG. 11, the centre bracket 132 is affixed to the rectangular plate 130 through permanent means, such as by welding. Alternatively, temporary fastening means such as bolts and nuts may also be used. The centre bracket 132 comprises a U-shaped bracket having a bottom side 138 and two sides 140, each of the two sides 140 having a threaded hole 142. The centre bracket 132 further comprises a set screw 144 and a pair of screw nuts 146. The upper end 104 of the elongated structure 102 is pivotally coupled to the brace structure 106 at the centre bracket 132. Specifically, the pivotal coupling is via the set screw 144 that passes through the upper end 104 and the threaded holes 142 of the sides 140. The set screw 144 allows the centre bracket 132, and consequently the brace structure 106, to rotate with respect to the elongated structure 102, such that the angle 216 of the retrofit device 100 with respect to the vertical can be adjusted. The retrofit device 100 can be locked at a desired angle 216 with the use of the screw nuts 146. The screw nuts 146 are screwed onto the set screw 144 and tightened against the sides 140. Other means of locking the centre bracket 132 known to the skilled person may also be used.

Each of the left bracket 134 and the right bracket 136 comprises a U-shaped bracket having a bottom side 148, an outer side 150, and an inner side 152. The outer side 150 comprises a threaded hole 154. Each of the left bracket 134 and the right bracket 136 is rotatably coupled or attached to the rectangular plate 130 via a fastener 156. The fastener 156 is of a bolt-and-nut type that allows each of the left bracket 134 and the right bracket 136 to rotate with respect to the rectangular plate 130. Thus, the angle of each of the left bracket 134 and the right bracket 136 can be adjusted to accommodate different types and models of the ladders 200. For example, some models of A-frame ladders have a wider base and a larger angle 212 between the frames. The adjustability of the left bracket 134 and the right bracket 136

advantageously allows the retrofit device 100 to be used on different ladders 200. Each of the left bracket 134 and the right bracket 136 can be locked at their desired angles by tightening the fasteners 156 against the rectangular plate 130.

5 In the preferred embodiment, with reference to FIG. 1 to FIG. 3, two retrofit devices 100 are used on the A-frame ladder 200 having four frames 202. The top portions of the retrofit devices 100 are coupled or attached to the frames 202 via the brace structures 106, specifically the left brackets 134 and the right brackets 136. Each of the frames 202 of the ladder 200 is positioned between the outer sides 150 and the
10 inner sides 152. As some ladders 200 have smaller frames 202, the ladder 200 may be loose when used with the retrofit devices 100. Thus, each of the left bracket 134 and the right bracket 136 comprises a threaded bolt 158. The threaded bolt 158 is fastened through the threaded holes 154 of the outer sides 150, and can be tightened against the frames 202, thereby locking the retrofit device 100 on the
15 ladder 200.

In an alternative embodiment, the brace structure 106 may not comprise the left bracket 134 and the right bracket 136 for attaching to the ladder 200. Instead, the left portion and right portion of the brace structure 106 may be directly coupled to the
20 frames 202 of the ladder 200. The direct coupling could be by means of screws, bolts, or pins into holes that are formed on the frames 202.

Referring back to the preferred embodiment, the A-frame ladder 200 is pivoted near the top platform 206. When the ladder 200 is in use, the separation distance 214
25 between the frames 202 could be affected, especially when someone accidentally kicks the ladder 200. This would be dangerous for someone who is working at the top platform 206 of the ladder 200, as he could fall due to the sudden movement. The attachment of the retrofit device 100 to the ladder 200 rigidly maintains the separation distance 214 between one frame 202 and another frame 202 of the
30 ladder 200. Specifically, the fixed distance between the left bracket 134 and the right bracket 136 rigidly maintains the angle 212 between the frames 202. The rigid maintaining or locking of the angle 212 consequently causes the separation distance 214 between the frames 202 to be rigidly maintained or fixed. Even though the

separation distance 214 varies along the frame 202, as described above and shown in FIG. 2, the rigid maintaining or locking of the angle 212 in turn rigidly maintains or locks the separation distance 214 anywhere along the frame 202. This advantageously prevents the frames 202 of the ladder 200 from accidentally coming together due to sudden impacts thereon, thus improving the safety of the ladder 200.

However, in the left bracket 134 and the right bracket 136, as the gap 160 between the outer sides 150 and the inner sides 152 is fixed, the range of ladder sizes that can be used with the retrofit devices 100 is restricted. For example, the retrofit device 100 cannot be used for ladders 200 that have frames 202 that are beyond the size of the gap 160. Thus, an alternative embodiment of the present disclosure would be to modify the left brackets 134 and the right brackets 136 to be expandable, such that the gap 160 can be adjusted to accommodate ladders 200 with larger frames 202. Additionally, the brace structure 106 can also be modified to become extendable, such that the retrofit device 100 can be used on A-frame ladders that are wider. One method of doing this is to modify the rectangular plate 130 to become extendable and lockable, such as the use of external and internal portions that are moveable relative to each other. Another method is to modify each of the left bracket 134 and the right bracket 136 so that the distance between them can be adjustable and lockable, such as improvising the fasteners 156 with sliding mechanisms.

In an alternative embodiment, instead of using the retrofit device 100 with an A-frame ladder 200, the retrofit device can be used with a typical two-frame ladder. The two-frame ladder would have two points of contact on the ground, and another two points of contact on the wall. The retrofit device 100 can thus be used with the two-frame ladder, with the brace structure 106 positioned on the frames of the two-frame ladder, and the base bracket 116 positioned on the ground. The retrofit device 100 thus provides an additional third point of contact or support on the ground for the ladder, specifically within the triangular area between the ladder and the wall. The retrofit device 100 also assists in rigidly maintaining the distance between the two frames of the ladder, especially in models whereby the ladder is compressible, i.e. the contraction of the two frames together into a single frame.

In the foregoing detailed description, embodiments of the present disclosure in relation to a retrofit device for a ladder are described with reference to the figures. Description of the preferred embodiment in the detailed description is not intended to callout specific or particular representations of the present disclosure, but merely to
5 illustrate non-limiting examples of the present disclosure. The present disclosure serves to address at least some of the mentioned prior art problems and issues. Although only some embodiments of the present invention are disclosed herein, it will be apparent to a person having ordinary skill in the art in view of this disclosure that numerous changes and/or modifications can be made to the disclosed
10 embodiments without departing from the scope of the present invention. The scope of the disclosure as well as the scope of the following claims is not limited to embodiments described herein.

Claims

1. A retrofit device for stabilizing a ladder having at least a first frame and a second frame supported on a ground, each frame forming an angle with respect to the vertical, the retrofit device comprising:
 - an elongated structure for providing an additional support on the ground for the ladder; and
 - a brace structure coupled to the elongated structure, the brace structure having a left brace bracket and a right brace bracket rotatably coupled thereto,
 - wherein the left brace bracket is attachable to the first frame of the ladder and the right brace bracket is attachable to the second frame of the ladder;
 - wherein each of the left and right brace brackets is rotatable with respect to the brace structure for respectively corresponding to the angles formed by the first and second frames with the vertical; and
 - wherein the brace structure is configured for rigidly maintaining a distance between the first frame and the second frame of the ladder.
2. The retrofit device as in claim 1, wherein at least one of the elongated structure and the brace structure is extendable.
3. The retrofit device as in claim 2, the elongated structure comprising an external portion and an internal portion telescopically arranged for moving relative to each other.
4. The retrofit device as in claim 3, the elongated structure comprising a plurality of locations, each location determining an overall length of the elongated structure.
5. The retrofit device as in claim 4, wherein the external portion and the internal portion are lockable at each of the plurality of locations.

6. The retrofit device as in claim 2, wherein the brace structure is lockable with respect to the elongated structure.

5 7. The retrofit device as in claim 1, further comprising a base bracket pivotally coupled to the elongated structure, wherein the base bracket provides the additional support on the ground.

8. The retrofit device as in claim 7, wherein the base bracket is lockable with respect to the elongated structure.

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9. The retrofit device as in claim 1, wherein each of the left and right brace brackets is lockable with respect to the brace structure.

10. The retrofit device as in claim 9, further comprising a fastening mechanism for
15 tightening each brace bracket on the ladder.

11. The retrofit device as in claim 7 or 8, further comprising a ground pad attachable to the base bracket, wherein the ground pad supports the ladder on the ground.

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12. The retrofit device as in claim 1, each of the left and right brace brackets comprising a gap for accommodating the first and second frames respectively, wherein each gap is adjustable in size by the left and right brace brackets, respectively.

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13. The retrofit device as in claim 1, the first and second frames of the ladder forming a pivot angle therebetween, wherein a length of the brace structure is adjustable.

30 14. The retrofit device as in claim 1, wherein the brace structure comprising a sliding mechanism for adjusting the length thereof.

15. The retrofit device as in any one of claims 1, 13, and 14, wherein a distance between the left and right brace brackets is adjustable.