

Modular ladder

The present invention relates to a modular safety ladder, an attachment device for attaching a modular safety ladder, a modular safety ladder set
5 of parts, a method for assembly of such a modular safety ladder, a method for attaching such a modular safety ladder to a structure and a tightening device set of parts.

Especially the invention relates to a modular safety ladder of the art mentioned in the opening part of claim 1. A ladder of this kind is e.g. disclosed
10 in EP 0 468 190 A1 or in KR 1020040087989 A.

Modular safety ladders are provided around harbours and on quay sides to prevent drowning accidents by assisting in rescuing persons from water where the distance from the water to the nearby safety area e.g. a harbour dock, quay, ship deck, cannot be passed by the person situated in the water.

15 A variety of different modular safety ladders have been suggested in the prior art.

JP2011122342 A2 describes a ladder for a jetty where light diodes (LED's) are integrated on the surfaces of a number of projecting parts located between a pair of vertical bar members of the ladder. The vertical bar member
20 is provided with an arm part connected with a horizontal plane of the jetty. A solar panel for powering the LED's is provided on the upper surface of the arm part. The energy from the solar panel is stored in a storage battery also provided in the arm part. The printed circuit board used for controlling the lighting of the LED's according to the energy accumulated from the solar panel is provided
25 in the arm part of the ladder as well.

WO 2014/075689 A1 discloses a modular safety ladder with light sources designed as light diodes and integrated in the bars of the ladder. By integrating the light diodes in the bars of the ladder such that the light diodes are countersunk relative to the surface of the bar, the light diodes will be automatically protected. While at the same time using light diodes emitting light in
30 different directions, the safety installation can be made visible in darkness when viewed from angles encompassing about 180 degrees. The modular safety ladder comprises a flexible intermediate section, separating the ladder in an upper

and a lower section, so that an exterior force can deflect the lower section of the ladder, without thereby bending the ladder on its upper section and damaging the lower section, since the exterior force will only influence the ladder section to deflection through the flexible section.

5 Referring to WO 2014/075689 A1 it has previously been achieved to create a modular safety ladder that may accommodate for a minor deflection of said ladder in a vertical direction e.g. due to ice packs.

 These solutions may be adequate on structures such as quay sides where the structure surface is approximately vertical. However, some modular
10 safety ladders should be mounted on structures having angled shapes and at the same time live up to requirements to robustness, visibility, and lifespan.

 Furthermore, modular ladders are often cumbersome and expensive to manufacture and assemble.

15 **Summary of the invention**

 On this background it may be an object of the present invention to improve a modular safety ladder as initially described and/or to alleviate, reduce or solve the problems and issues in the prior art.

 Other objects of the invention may include to provide an attachment
20 device for attaching a modular safety ladder, a method for attachment of a modular safety ladder, and a modular safety ladder set of parts comprising such a modular safety ladder.

 Another object of the invention is to provide a simpler/lower cost method for manufacture and/or method of assembly of a modular safety ladder.

25 These and further objects may be met by the invention, which, according to a first aspect, relates to a modular safety ladder comprising

 a number of rungs connecting a first and a second guide rail, and
 an upper ladder module and a lower ladder module,

 said modular safety ladder being able to be arranged in an un-assembled configuration, in which said upper ladder module is un-attached to said
30 lower ladder module, and an assembled configuration, in which said upper ladder module is attached to said lower ladder module,

- wherein each ladder module comprises
a first and a second guide rail portion, and
a rung connecting the first and second guide rail portions, and
a tightening device which in the assembled configuration upon activa-
5 tion pulls said ladder modules towards each other,
- wherein the modular safety ladder further comprises
a spacer, the spacer in the assembled configuration being positioned
to space apart the first guide rail portion of the upper ladder module from the
first guide rail portion of the lower ladder module,
- 10 wherein a collar part of the spacer in the assembled configuration is
positioned between a surface of the first guide rail portion of the upper ladder
module and an opposite surface of the first guide rail portion of the lower ladder
module so that tightening of the tightening device will squeeze or pinch or com-
press said collar part of the spacer between said surfaces,
- 15 the spacer comprising an upper protrusion, wherein at least a part of
the upper protrusion is arranged in a first support member channel of the upper
ladder module when the modular safety ladder is arranged in the assembled
configuration,
- the spacer comprising a lower protrusion, wherein at least a part of the
20 lower protrusion is arranged in a first support member channel of the lower
ladder module when the modular safety ladder is arranged in the assembled
configuration, and
- the spacer comprising the collar part, said lower and upper protrusions
extending in opposite directions away from said collar part.
- 25 The spacer separates the ladder modules from each other and may
act as a pressure absorber when forces acts on the ladder modules. When the
modular safety ladder is tightened, the spacer may assist in providing a tight
and stiff modular safety ladder, even when position on structures with angled
surfaces.
- 30 Furthermore, the shape e.g. height and/or angle of the spacer may be
varied depending on desire. This enables the modular safety ladder to be po-
sitioned on uneven surfaces with varying slopes, which are often the case in

quays/wharfs.

By providing a modular safety ladder that may accommodate for different profiles in different structural settings, a more versatile modular safety ladder is provided, that may be used in any setting where prior art non-modular, straight ladders cannot be used.

When the tightening device is operated to tighten the ladder modules to each other, the spacer will experience a force from each ladder module that said spacer is arranged between. Due to the flexibility and resiliency of the spacer, the spacer will deform. This deformation results in a spring force as the resilient material will attempt to restore its original shape. The spring force may assist in maintaining the tightening of the modular safety ladder.

The spacer may be an element that is deformable under the influence of a particular force and/or capable of recoiling back into substantially its original shape once the particular force is removed.

To define the modular safety ladder spatially, the guide rails may define a longitudinal axis extending in an axial direction, with a radial direction extending radially from the axial direction.

Furthermore, the innovative combination of the flexibility of a rope ladder with the rigidity of an ordinary ladder, an extremely robust modular safety ladder may be provided.

The modular construction of the modular safety ladder may enable, that the length and shape of said modular safety ladder may easily be customized to fit any quayside.

Additionally, the modular safety ladder is maintenance-free and the modular construction may make it possible to replace damaged parts individually without the need for a total replacement of the entire modular safety ladder, when an individual part has been damaged and needs replacement.

In the context of the present specification, the term "attached" may be understood as being joined, fastened, and/or connected to something, including being releasably attached.

In some embodiments the spacer preferably comprises a through hole so as to allow for at least a part of a connection member to extend through said

through hole of the spacer.

The modular safety ladder may be in different states in the assembled configuration, e.g. the tightening of the tightening device may be more or less tight providing for different states of tightness of said ladder in the assembled
5 configuration.

The tightening of the tightening device will move said opposite surfaces of the first guide rail portion of the upper ladder module and the first guide rail portion of the lower ladder module towards each other with the spacer arranged in between said surfaces, whereby each surface will exert a force on
10 the spacer, the two forces being exerted in opposite directions on said spacer whereby at least a part of the spacer is squeezed or pinched or compressed between said surfaces.

The size of the forces exerted on the spacer depends on the tightening of the tightening device. The more the tightening device is tightened, the larger
15 the forces on the at least a part of the spacer will be.

In some embodiments the first guide rail portion comprises a first support member having a first support member channel and the second guide rail portion comprises a third support member having a third support member channel.

20 Preferably the upper ladder module, the lower ladder module and the spacer is strung on the elongated member in the assembled configuration of the modular safety ladder.

Thereby providing a simple modular safety ladder, which is easy to assemble and economical to produce.

25 In some embodiments the first support member of the upper ladder module and the first support member of the lower ladder module, when the modular safety ladder is arranged in the assembled configuration, are positioned on each side of said spacer.

In some embodiments the modular safety ladder further comprises a
30 connection member, preferably elongated, extending along the guide rail and connected to said tightening device.

The connection member may have a plug end and an opposite tightening end.

In some embodiments the tightening device is connected to the tightening end of the connection member in the assembled configuration of the modular safety ladder.

In some embodiments the upper ladder module is connected to the plug end of the connection member in the assembled configuration of the modular safety ladder.

It will be understood that the plug end of the connection member may be connected to various structures/elements not limited to parts of the modular safety ladder itself e.g. a grip handle on a quay, as long as it allows tightening of the modular safety ladder.

In some embodiments the ladder module is manufactured in one piece, preferably by injection molding, or potentially by 3D printing.

The modular safety ladder according to the invention may thus provide a versatile and durable modular safety ladder, which is easy and economically advantageous to produce.

Furthermore, the modular safety ladder may provide a simpler/lower cost method for manufacture and/or method of assembly of said ladder.

In the context of the present invention, the general term “attached to” is to be understood as being connected to in any way, not limited to being in direct contact with.

It is to be understood that the lower ladder module may be identical to the upper ladder module and vice versa. The material and/or mechanical properties described in relation to the upper ladder module may therefor also be valid for the lower ladder module and vice versa.

The skilled person will realize that the modular safety ladder according to the first aspect of the invention may be designed to fit x numbers of ladder modules according to desire, the desired number of ladder modules being attached to each other by means of a desired number of spacers to match the ladder modules and a desired number of tightening mechanisms.

Hereby the user may easily customize the modular safety ladder to

different needs.

In the context of this specification, the upper ladder module is the uppermost ladder module of the modular safety ladder and the lower ladder module is the lowermost ladder module of the modular safety ladder.

5 For ease of understanding the ladder is in this specification described as having two ladder modules i.e. an upper and a lower ladder module, but the modular safety ladder may comprise a plurality of ladder modules arranged between the upper and lower ladder modules.

Each support member is defined as having an upper part and an opposite lower part. When the assembled modular safety ladder is positioned on a wharf, the lower part is closer to the water, or further down in the water, than the upper part. The support member channel extends from the upper part towards the lower part in a longitudinal direction of the ladder module and all the way through the support member.

15 The support member comprises an outer surface and an inner surface, wherein the channel is formed by the inner surface of the support member. It is to be understood that the circumference of the inner surface of the support member corresponds to the circumference of the support member channel.

The support member channel may also be defined as having an upper and a lower part corresponding to the upper and lower parts of the support member.

The support member and/or the support member channel may have any suitable shape, such as square, circular, rectangular or drop shaped.

25 The support member channel may have a shape substantially matching the shape of the support member.

The support member comprises a support member channel and a recess opening into the channel.

The spacer comprises an upper protrusion, wherein at least a part of the upper protrusion is arranged in said first support member channel of the upper ladder module when the modular safety ladder is arranged in the assembled configuration.

Additionally, the spacer comprises a lower protrusion, wherein at least

a part of the lower protrusion is arranged in said first support member channel of the lower ladder module when the modular safety ladder is arranged in the assembled configuration.

5 In some embodiments the through of the spacer extends through the upper protrusion and/or the lower protrusion.

By having a lower and/or upper protrusion(s), the spacer may be maintained in position between the ladder modules. If the spacer was arranged between the modules without having the protrusions to help ensure its position, it may during movements of the modules or by influence from external forces, be
10 pushed to one side and thus not provide the desired pressure absorption function. Furthermore, in such a situation the modules may then be able to rub against each other and cause enough damage to render the modular safety ladder unusable.

In some embodiments the protrusion of the spacer may have a shape
15 and size substantially matching the shape and size of the support member channel of the support member designated for receiving said protrusion.

Additionally or alternatively, the flexible member comprises a collar part, said lower and upper protrusions preferably extending in opposite directions away from said collar part.

20 In some embodiments the collar part has a maximum circumference that is larger than the maximum circumference of the upper and/or lower protrusion.

The collar part may act as a stopper, ensuring that the spacer is not able to move all the way into the support member channel.

25 The protrusions may have any suitable shape such as circular, rectangular, tapered or drop shaped.

The skilled person will understand that the support member channel may have any shape with or without an additional recess or the like, as long as said shape allows for positioning of the protrusion.

30 The circular shape or a shape close to the circular shape such as the drop shape, may provide strength advantages compared to a square shape.

The tip of the drop shape may allow for correct orientated positioning

of the protrusion in the support member channel.

In some embodiments the first support member channel of the upper ladder module and/or the first support member channel of the lower ladder module have/has a substantially drop shaped cross-section, preferably the upper protrusion and/or the lower protrusion of said spacer have/has a substantially drop shaped cross-section, so as to match the shape of the first support member channel and provide a frictional fit, when the protrusion is inserted into the channel in the assembled configuration of said modular safety ladder.

This may ensure that a snug fit will be created when the protrusion is arranged in the support member channel, so as to help keep the protrusion in the support member.

Additionally or alternatively, the spacer may be somewhat compressed in a radial direction by the support member, when the modular safety ladder is in the assembled configuration, and the spacer may exert a force in the radial direction on the support member. This may create tension between the spacer and the support member, so that the spacer may be releasably secured in said channel of said support member.

In some embodiments the circumference of the upper and/or lower protrusion(s) is approximately equal to or larger than a circumference of the part of the first support member channel, where the protrusion is arranged when the modular safety ladder is in the assembled configuration.

Additionally or alternatively, the material of the spacer may provide static friction between the inner surface of the support member and the outer surface of the protrusion, when the modular safety ladder is arranged in the assembled configuration. The static friction may additionally help to maintain the position of the protrusion in the support member channel.

In some embodiments the absolute value of the difference in circumference between the upper protrusion and the circumference of the lower part of the first support member channel of the upper ladder module is higher than the absolute value of the difference in circumference between the lower protrusion and the circumference of the upper part of the first support member channel of the lower ladder module.

In some embodiments the force that is required to separate the flexible member and the upper ladder module, i.e. remove the upper protrusion from the lower part of the first support member channel of the upper ladder module, is higher than the force that is required to separate the flexible member and the lower ladder module, i.e. remove the lower protrusion from the upper part of the first support member channel of the lower ladder module.

Thereby the spacer will be more attached to the lower part of the support member than the upper part of the support member.

This may ensure that when the modular safety ladder modules are moved in relation to each other, e.g. away from each other during use, such as when a person steps on the rung of the lower ladder module. During said use one of the protrusions of the spacer allows the spacer to move away from the lower ladder module, i.e. the lower protrusion will slide out preferably a bit out of the support member channel upper part of the lower ladder module, thus allowing the modular safety ladder to accommodate for the additional forces put on the ladder modules during use.

In the context of the present invention, the term “flexible” may be viewed as being interchangeable with the term “resilient” and may be understood as being able to recoil and/or spring partially or completely back into shape after bending, stretching, being compressed, and/or any form of deformation.

In some embodiments, the hardness of the spacer is 1 – 10, 10 – 20, 20 – 30, 30 – 40, 40 – 50, 50 – 60, 60 – 70, 70 – 80, 80 – 90, 90 – 100 shore A.

The term “hardness” in the context of the present invention may be defined as a material's resistance to permanent indentation. There are different Shore Hardness scales for measuring the hardness of different materials. The Shore A Hardness Scale measures the hardness of flexible mold rubbers that range in hardness from very soft and flexible, to medium and somewhat flexible, and to hard with almost no flexibility at all. The scale results in a value between 0 and 100, with higher values indicating a harder material.

In the context of the present specification, the term “x hardness shore

A” is to be understood as being a value x on the Durometer Shore A Hardness Scale measured according to ASTM D2240 and measured using the ASTM D2240 type A scale. The hardness is measured in a non-deformed state of the object or material to be measured, i.e. for the spacer according to the invention,
5 measured in the un-assembled configuration of the modular safety ladder. The final value of the hardness depends on the depth of the indenter after it has been applied for 15 seconds on the material/object.

The shore A scale is used as an example as to performing a measurement of the hardness of the spacer. Depending on the selected material of the
10 spacer, e.g. the Shore B Hardness Scale could also be used

In some embodiments, the hardness of the spacer is 1 – 10, 10 – 20, 20 – 30, 30 – 40, 40 – 50, 50 – 60, 60 – 70, 70 – 80, 80 – 90, 90 – 100 shore B.

In some embodiments the first guide rail portion comprises at least 2
15 support members, preferably a first, a second, a third and a fourth support member, each support member preferably having a support member channel.

In some embodiments the ladder module comprises at least two spacers, preferably four spacers.

In some embodiments the ladder module comprises a first side panel,
20 the first side panel being connected to the first and second support members, and/or the ladder module comprises a second side panel, the second side panel being connected to the third and fourth support members.

By providing a ladder module with four support members and four ap-
25 pertaining channels a more rigid construction may be achieved, since the channels will experience different loads e.g. stress, strain, tension or pull at the same time during use and with this construction be able to accommodate for this.

In some embodiments the modular safety ladder further comprises a plug. Preferably the plug end of the connection member is attached to said
30 plug, and said plug, in the assembled configuration of the modular safety ladder, is arranged in the first support member channel of the upper ladder module.

The plug may comprises a head and a body with a through hole, the

body of said plug is preferably arranged in the upper part of the first support member channel in the assembled configuration of the modular safety ladder.

In some embodiments the connection member may be attached to the body of the plug by any means, preferably via the through hole by an eye splice.

5 In some embodiments the body of the plug may have a substantially drop shaped cross-section, so as to match the shape of the first support member channel and provide a snug fit, when the body is inserted into the support member channel in the assembled configuration of said modular safety ladder.

This may ensure that a snug fit will be created when the body of the
10 plug is arranged in the support member channel, to keep the body of said plug in the support member channel, ensuring that the body will not rotate within the channel.

In some embodiments the tightening device comprises a thread element, a through hole, a bushing and a nut.

15 The through hole preferably extends through the thread element, so that the connection member may extend through said through hole of the thread elements, when the modular safety ladder is in the assembled configuration.

Thereby a simple and easy way of tensioning the modular safety ladder may be provided. The tightening device may be operated manually by e.g.
20 hand or with an instrument such as a wrench.

In some embodiments the thread element is an elongated, preferably cylindrical element.

In some embodiments the thread element comprises a threaded outer
25 surface.

The thread element may comprise a track extending along a part of the structured surface.

In some embodiments the bushing has a substantially drop shaped cross-section, so as to match the shape of the bottom part of the first support
30 member channel of the lower ladder module.

In an assembled configuration of the tightening device, the bushing encircles the thread element.

The bushing may comprise a protrusion extending from an inner surface.

The protrusion may have a shape so as to match the track of the thread element.

5 Thereby the track may guide the movement of the bushing along the thread element when the tightening device is operated to tighten or loosen the modular safety ladder.

Furthermore, the track may ensure that the bushing is not able to rotate around the thread element.

10 In some embodiments the nut comprises a threaded inner surface so as to match the outer threaded surface of the thread element.

The nut is adapted to be screwed on the thread element.

To ensure that the bushing stays on the thread element, the track does not extend all the way to the end of the threaded surface, so that the treads at
15 one end of the thread element blocks the protrusion of the bushing to move past said threads. The nut is screwed on the other side of the thread element.

In the assembled configuration of the modular safety ladder, the bushing is arranged inside the lower part of the first support member channel of the lower ladder module.

20 The connection member extends through the thread element, wherein the tightening end of the connection member is arranged so that it cannot move past (i.e. into) the end of said thread element that is arranged outside the support member channel.

The tightening end of the connection member may be tied in a knot.

25 When the nut is screwed one way, the thread element moves further into the support member channel.

When the nut is screwed the other way, the thread element moves further out of the support member channel, thus stretching the connection member and thereby tightening the modular safety ladder.

30 In some embodiments the tightening device further comprises an interlocking ratchet element such as inclined teeth between the bushing and the nut.

This may ensure that the nut is one-way rotational and may prevent the tension in the construction from being unintentionally released.

In some embodiments the modular safety ladder may comprise more than one tightening device, preferably four tightening devices.

5 In some embodiments the tightening end of the connection member may be attached to an end of the thread element, e.g. by tying a knot on the connection member that is larger than the through hole of the thread element, so that the knot cannot pass through said through hole.

10 In some embodiments the tightening device further comprises a locking element such as an interlocking ratchet element preferably in the form of inclined teeth arranged between the bushing and the nut.

15 Hereby a nut may be provided which may be one-way rotational when the tightening device is assembled, and thereby may prevent the tension of the modular safety ladder in the assembled configuration from being unintentionally released.

 In some embodiments the nut comprises a protruding collar.

 This collar may cover the gap between the nut and the bushing, thereby preventing fingers from a person operating the tightening device from getting pinched during operation.

20 In some embodiments, the first side panel and the first support member and/or the first side panel and the first and the second support members and/or the second side panel and the third support member and/or the second side panel and the third and fourth support members and/or the rung and the guide rail portions are integrally formed.

25 In the content of this specification the term "integrally formed" may be understood as being a continuous material formation.

 In some embodiments the modular safety ladder further comprises a light unit adapted to illuminate the modular safety ladder, preferably the rungs, during periods with low visibility such as at night or with bad weather.

30 In some embodiments the light unit is an integrated solar-powered lamp.

 This may make the modular safety ladder more visible during night

and/or bad weather.

The light unit may be solar powered.

The light unit may be made of UV stabilized polycarbonate or another transparent material, the light unit having of a top and a base part which are
5 assembled and sealed to be waterproof.

The top part may be formed with a surface that provides good light transmission and/or is slip-proof.

The bottom part may be designed with integrated lenses for optimal light distribution on the modular safety ladder.

10 The bottom part may be formed with ribs for structural strength and/or may be provided with a mounting device for attaching to the modular safety ladder.

The light unit may be mounted to the top attachment device, where it easily slides into place and is fixed with two slide-locks.

15 The ladder modules may be fabricated in a vibrant color.

The light unit and/or the vibrant color may make the modular safety ladder visible both at day time and at night time.

The light unit and/or the vibrant color may allow the modular safety ladder to be visible in darkness when viewed from angles encompassing 360
20 degrees.

Further the safety ladder may be recognisable from a great distance.

An attachment device for attaching a modular safety ladder according to the invention to a desired structure such as a wharf or quay, may comprise
a bracket adapted to be attached to said desired structure,

25 a clamp, preferably two clamps, each clamp comprising a gripping part, said gripping part being shaped so as to be able to grip a part of the modular safety ladder having a structured surface, and

a base part attached to said gripping part and adapted to be secured to said bracket,

30 wherein a structured surface of the gripping part is shaped so as to substantially match the shape of said part of the modular safety ladder, so that the gripping part fixates the modular safety ladder, when the modular safety

ladder is mounted to the attachment device.

Hereby an attachment device is provided which may provide easy installing and re-installing of the entire safety ladder or damaged ladder modules as a simple procedure.

5 In some embodiments the bracket has a u-shape.

In some embodiments the gripping part has a semi-circular shape.

In some embodiments a part of the support member comprises a structured surface to match the structured surface of the gripping part.

10 In some embodiments the gripping part and/or the part of the support member comprises a threaded or waved surface.

The bracket may be installed on the surface of the construction where the modular safety ladder is to be mounted, such as a quay or wharf wall.

Each clamp may interlock with the support member of the modular safety ladder, and with the bracket, whereby said ladder is fixated to the wall
15 both horizontally and vertically.

The modular construction of the modular safety ladder may allow to freely position the modular safety ladder on any desired angled point on the quay wall, making it possible to mount a modular safety ladder that is safe and durable in new positions, that have not been possible with the prior art modular
20 safety ladders.

In some embodiments the ladder module is manufactured from at least 10 %, at least 20 %, at least 30 %, at least 40 %, at least 50 %, at least 60 %, at least 70 %, at least 80 %, at least 90 % or at least 95 % of polypropylene (PP), preferably glass reinforced polypropylene (PP), or polyamide (PA), preferably glass reinforced polyamide (PA), or glass fiber.
25

It is to be understood that the ladder modules may be manufactured by any suitable material and/or composition of materials, that will provide the advantages obtained with the safety ladder according to the invention.

In some embodiments the attachment device is manufactured from at least 10 %, at least 20 %, at least 30 %, at least 40 %, at least 50 %, at least 60 %, at least 70 %, at least 80 %, at least 90 % or at least 95 % of stainless steel or fiberglass.
30

In some embodiments the spacer is manufactured from a material comprising at least 10 %, at least 20 %, at least 30 %, at least 40 %, at least 50 %, at least 60 %, at least 70 %, at least 80 %, at least 90 % or at least 95 % of a rubber material and/or a rubber compound and/or a material or a combination of materials selected from the group consisting of silicone, silicone rubber, natural rubber, synthetic rubber, TPE, PTFE, EPDM, HBNR, neoprene, polyethylene, polypropylene, HDPE, polystyrene and nylon/polyamide.

In some embodiments the ladder module and/or the plug and/or the thread element and/or the bushing and/or the nut and/or the gripping element is manufactured from at least 10 %, at least 20 %, at least 30 %, at least 40 %, at least 50 %, at least 60 %, at least 70 %, at least 80 %, at least 90 % or at least 95 % of glass reinforced polypropylene (PP) or glass reinforced polyamide (PA), preferably glass reinforced nylon (PA66 GF30) or glass reinforced Polypropylene (PP GF30).

The connection member may be manufactured from a synthetic rope material or rope material like the material sold under the trademark Dynema.

The bracket may be manufactured from stainless steel or reinforced high strength plastic.

The composition and materials of the part of the modular safety ladder that is or may be positioned below water depending on the tide, may ensure a longer lifespan, as no parts are formed by metal, which eventually will erode. Likewise, the modular safety ladder may also be more safe to use, as eroded parts will not potentially break off during use.

By providing a modular safety ladder which is formed mostly of corrosion free material e.g. synthetic material, the modular safety ladder may be more robust against the harsh environment.

Especially the part of the modular safety ladder which is below the waterline may have a prolonged life span compared to prior art modular safety ladders, where corrosion will damage and break the parts below the waterline.

Furthermore, due to the material selection the modular safety ladder requires a minimal amount of maintenance, preferably no substantial maintenance – only occasional cleaning – and the modular safety ladder may maintain

its full functionality throughout its lifetime.

Additionally the materials may provide a much lighter modular safety ladder compared to prior art metal or wood modular safety ladders. A 3-meter modular safety ladder according to the invention will weigh around 10 – 20 kilos, preferably around 18 kilos.

A material of the spacer and/or ladder module may comprise additives and/or fillers, including colouring agents and/or softening agents and/or UV stabilizers.

By providing a modular safety ladder with a bright colour and a light unit, said modular safety ladder will be visible 24 hours a day, all year round without the need for additional illuminating equipment.

According to a third aspect the invention relates to a modular safety ladder set of parts comprising a modular safety ladder according to the first aspect, and an attachment device according to the second aspect.

According to a fourth aspect the invention relates to a method for assembly of a modular safety ladder comprising the steps of

- providing said modular safety ladder according to the first aspect,
- positioning the spacer to space apart the first guide rail portion of the upper ladder module from the first guide rail portion of the lower ladder module,

wherein at least a part of the spacer in the assembled configuration is positioned between a surface of the first guide rail portion of the upper ladder module and an opposite surface of the first guide rail portion of the lower ladder module, and

- activating said tightening device to pull said ladder modules towards each other, so that said tightening of the tightening device squeezes or pinches or compresses said at least a part of the spacer between said surfaces.

Hereby a modular safety ladder which may be easy and simple to assemble is provided.

The modular safety ladder may be shipped from seller to buyer in the assembled or the un-assembled configuration.

According to a fourth aspect the invention related to a method for attaching the modular safety ladder according to the first aspect to a structure

such as a quay or wharf by means of the attachment device comprising the steps of

- providing said modular safety ladder having a ladder module with a structured surface,
- 5 - providing said attachment device,
- attaching the bracket on said structure,
- attaching two clamps having on opposite sides of the bracket,
- positioning the ladder module so that a part of the support member with a structured surface is arranged inside the gripping part of the clamp, and
- 10 - tightening the clamps, so that the as to secure the ladder module in a fixed position.

wherein a structured surface of the gripping part is shaped so as to substantially match the shape of said part of the modular safety ladder, so that the gripping part fixates the modular safety ladder, when the modular safety
15 ladder is mounted to the attachment device.

The modular safety ladder according to the first aspect of the invention may comply with the international standard for rescue ladders: DS/EN 14329 Inland navigation vessels- Installation of berths and loading areas, which requires that berths and loading areas shall have stairs or modular safety ladders
20 no more than 30 m apart or 60 m apart depending on the difference between water levels.

The modular safety ladder may fit in most niches when replacing old rescue ladders.

The modular safety ladder should preferably be installed in a niche or
25 between fenders.

In some embodiments the distance between the rungs is 30 cm.

In some embodiments the modular safety ladder further comprises a grip-handle, preferably curved, preferably two grip-handles, for mounting on top of quayside in connection to the modular safety ladder.

30 The different aspects of the present invention can be implemented in different ways, including as a modular safety ladder, an attachment device for attaching a modular safety ladder, a modular safety ladder set of parts, a

method for assembly of such a modular safety ladder and a method for attaching such a modular safety ladder to a structure as described above and in the following, each potentially yielding one or more of the benefits and advantages described in connection with at least one of the aspects described above, and
5 each having one or more embodiments corresponding to the embodiments described in connection with at least one of the aspects described above and/or disclosed in the dependent claims.

Furthermore, it will be appreciated that embodiments described in connection with one of the aspects described herein may equally be applied to the
10 other aspects.

The invention maybe used in connection with other working facilities e.g. liquid manure tanks, where the security is heightened for persons working alone and being in danger of falling into the tank.

According to a fifth aspect the invention relates to a tightening device
15 set of parts for tightening an upper ladder module and a lower ladder module, said modules being able to be arranged in an un-assembled configuration, in which said upper ladder module is un-attached to said lower ladder module, and an assembled configuration, in which said upper ladder module is attached to said lower ladder module, the tightening device set of parts comprising:

20 the upper ladder module and the lower ladder module, said modules being able to be arranged in an un-assembled configuration, in which said upper ladder module is un-attached to said lower ladder module, and an assembled configuration, in which said upper ladder module is attached to said lower ladder module;

25 a tightening device,
a connection member extending along the modules and connected to said tightening device,

a spacer, the spacer in the assembled configuration being positioned to space apart the modules, the spacer comprising an upper protrusion,
30 wherein at least a part of the upper protrusion is arranged in said first support member channel of the upper ladder module when the modular safety ladder

is arranged in the assembled configuration, the spacer comprising a lower protrusion, wherein at least a part of the lower protrusion is arranged in said first support member channel of the lower ladder module when the modular safety ladder is arranged in the assembled configuration, and the spacer comprising
5 a collar part, said lower and upper protrusions extending in opposite directions away from said collar part;

wherein the tightening device in the assembled configuration upon activation pulls said ladder modules towards each other, wherein at least a part of the spacer in the assembled configuration is positioned between a surface
10 of the upper ladder module and an opposite surface of the lower ladder module so that tightening of the tightening device will squeeze or pinch or compress said at least a part of the spacer between said surfaces.

Hereby an easy way to assemble a modular ladder is provided. Furthermore, the tightening device set of parts is cheap to manufacture and light
15 weight, which may help to provide an improved way to assemble a safety ladder.

The drawings

The above and/or additional objects, features and advantages of the
20 present invention will be further elucidated by the following illustrative and non-limiting detailed description of embodiments of the present invention with reference to the appended drawings.

Fig 1 shows a modular safety ladder according to the first aspect on the invention in an assembled configuration, the modular safety ladder being
25 attached to an attachment device according to the second aspect on the invention.

Fig 2 shows a perspective view of a ladder module of the modular safety ladder in an un-assembled configuration.

Fig 3A shows a front view of the ladder module of figure 2.

30 Fig 3B shows a top/bottom view of the ladder module of figure 2.

Fig 3C shows a rear view of the ladder module of figure 2.

Fig 4 shows an exploded view of the modular safety ladder according

to the first aspect with an upper and a lower ladder module in the un-assembled configuration.

Fig 5 shows three ladder modules, 12 spacers and four connection members in the assembled configuration.

5 Fig 6A shows an exploded view of the tightening device in an un-assembled state.

Fig 6B shows the tightening device in an assembled state.

Fig 6C shows a perspective view of a bushing.

Fig 7 show an exploded view of an attachment device according to a
10 second aspect of the invention.

Detailed description of embodiments of the invention

In the following description, reference is made to the accompanying figures, which show, by way of illustration, how the invention may be practiced.

15 Turning to figure 1 which shows a modular safety ladder 1 in an assembled configuration.

The modular safety ladder 1 comprises a number of rungs 130 connecting a first guide rail 10 and a second guide rail 20.

The modular safety ladder is built up of a desired number of ladder
20 modules similar to the upper and/or lower ladder modules and extends in a longitudinal direction along a longitudinal axis L.

If the modular safety ladder is arranged on a surface with slopes having different angles, then each ladder module defines its own longitudinal axis.

In the shown embodiment the modular safety ladder comprises an upper
25 ladder module 100, a lower ladder module 700 and 8 intermediate ladder modules similar to the upper and/or lower ladder modules.

The modular safety ladder 1 may be built with any number of ladder modules.

Said modular safety ladder 1 is able to be arranged in an un-assembled
30 bled configuration, in which said upper ladder module 100 is un-attached to said lower ladder module 700, and an assembled configuration, in which said upper ladder module is attached to said lower ladder module.

The modular safety ladder 1 is attached to two attachment devices 500.

A light unit 600 is mounted to the uppermost attachment device 500.

The light unit 600 illuminates the rungs 130 and the first and second
5 guide rails 10, 20 to make the modular safety ladder more visible at night.

Four tightening devices 300 which in the assembled configuration upon activation pulls said ladder modules 100, 700 towards each other is arranged adjacent to the lower ladder module 700.

Turning to figure 2 and 3A-3C which shows different view of a ladder
10 module 100 of the modular safety ladder in an un-assembled configuration.

Each ladder module 100 comprises a first and a second guide rail portion 110, 120, and a rung 130 connecting said first and second guide rail portions.

The rung 130 has a cylindrical shape extending between the first and
15 second guide rail portions 110, 120.

Four protruding lines 131 extending along the rung 130 constitute an anti-slip feature.

The transition between the rung 130 and the first and second guide rail portions 110, 120 is curved, allowing loads exerted on the rung 130 to be
20 optimally transferred between the rung and the first and second guide rail portions.

The first guide rail portion 110 comprises a first support member 111 having a first support member channel 113 and a second support member 115 having a second support member channel 117.

25 The second guide rail portion 120 comprises a third support member 121 having a third support member channel 123

All four support member channels extend along the longitudinal axis L.

The first support member 111 is arranged opposite the third support
30 member 121.

The first and the third support members each comprises a structured

surface 112, 122, here shown as a threaded surface for engaging with an attachment device 500 (as seen on figure 1).

The second support member 115 is arranged opposite the fourth support member 125. These may be useful as handles when using the modular
5 safety ladder.

Each support member is defined as having an upper part and an opposite lower part. Illustrated is the first support member 111 having an upper part 111U and a lower part 111L.

The support member channel 113 extends all the way through the support member 111.
10

The support member comprises an outer surface and an inner surface, wherein the channel is formed by the inner surface of the support member.

The support member channel 113 also has an upper part 113U and a lower part 113L corresponding to the upper and lower parts 111U, 111L of the
15 support member 111.

The support member and/or the support member channel have a substantially drop shaped cross section.

Each module 100 comprises a first side panel 114 connecting the first and the second support members 111, 115, and a second side panel 124 connecting the third and fourth support members 121, 125.
20

The rung 130 extends between the first and second side panels 114, 124.

The rung 130 is hollow and opens into an opening in each side panel.

Turning to figure 4 which shows an exploded view of the modular
25 safety ladder 1 and to figure 5 which shows three ladder modules, 6 spacers and four connection members in the assembled configuration.

The modular safety ladder 1 further comprises a spacer 200.

The spacer 200 is in the assembled configuration positioned to space apart the first guide rail portion 110 of the upper ladder module 100 from the
30 first guide rail portion 710 of the lower ladder module 700.

In the shown embodiment the modular safety ladder comprises four spacers 210, 220, 230, 240.

The hardness of the spacer is 65 - 75 shore A.

A part 217 of the spacer 210 is in the assembled configuration positioned between a surface of the first guide rail portion of the upper ladder module and an opposite surface 740 of the first guide rail portion of the lower ladder module so that tightening of the tightening device will squeeze or pinch or compress said at least a part of the spacer between said surfaces.

The length of the spacer may vary. This may make it possible to design a modular safety ladder with a shape to match the profile at any given quay wall.

In the following the description of the spacer 240 is to be understood as being relevant for each of the four spacers 210, 220, 230, 240, and that the spacer 240 is only selected for illustration purposes.

The spacer 240 comprises an upper protrusion 243. The through hole 241 extends through said upper protrusion 241.

When the modular safety ladder 1 is arranged in the assembled configuration, said upper protrusion 243 extends into the fourth support member channel 127 of the upper ladder module 100.

The spacer 240 further comprises a lower protrusion 245. The through hole 241 extends through the lower protrusion 245.

When the modular safety ladder is arranged in the assembled configuration, said lower protrusion 245 extends into said fourth support member channel 727 of the lower ladder module 700.

In some embodiments the protrusion of the spacer may have a shape and size substantially matching the shape and size of the support member channel of the support member designated for receiving said protrusion.

The spacer comprises a collar part, said lower and upper protrusions preferably extending in opposite directions away from said collar part.

In some embodiments the collar part 247 which acts as a stopper, ensuring that the spacer is not able to move all the way into the support member channels.

The protrusions 241, 245 may have any substantial drop shaped cross section.

The first, second, third and fourth support member channels of the upper ladder module and of the lower ladder module have a substantially drop shaped cross-section, so as to match the shape of the upper and lower protrusions of the spacers and provide a frictional fit, when the protrusion is inserted
 5 into the channel in the assembled configuration of said modular safety ladder.

The ladder module 100 is manufactured in one piece, preferably by injection molding.

The modular safety ladder 1 further comprises four elongated connection members 400 extending along the first guide rail 10 and second guide rail
 10 20.

The material of the connection member is chosen to avoid/minimize the materials ability to be extended due to i.e. load and heat stress.

The connection member 400 has a plug end 401 and an opposite tightening end 403.

15 The modular safety ladder further comprises a plug 800 attached to the plug end 401 of the connection member 400.

The plug 800 may act as an anchor point for the connection member 400 at the top of the modular safety ladder 1.

The plug 800 is, in the assembled configuration of the modular safety
 20 ladder, arranged in the first support member channel 113 of the upper ladder module 100.

The plug 800 comprises a head 801 and a body 802 with a transverse through hole 803.

25 The body 802 of said plug is arranged in the upper part 113U of the first support member channel 113.

The connection member 400 is attached to the body 802 of the plug by any means, preferably via the through hole 803 by an eye splice 401.

The body 802 of the plug has a substantially drop shaped cross-section, so as to match the shape of the first support member channel 113 and
 30 provide a snug fit, when the body is inserted into the support member channel in the assembled configuration of said modular safety ladder 1.

The head 801 of the plug seals the support member channel 113, so

that the connection member 400 may be protected from sunlight and unauthorized access.

The upper ladder module 100, the lower ladder module 700 and the spacer 200 is strung on the elongated connection member 400 in the assembled configuration of the modular safety ladder 1.

Turning to figure 6A-C which shows an exploded view of the tightening device 300 in an un-assembled state, the tightening device 300 in an assembled state and a perspective view of a bushing 320.

The tightening device 300 comprises a thread element 310, a through hole 315, a bushing 320 and a nut 330.

The through hole 315 extends through the thread element 310, so that the connection member 400 may extend through said through hole of the thread elements, when the modular safety ladder is in the assembled configuration.

The thread element 310 is an elongated, cylindrical element comprising a threaded outer surface 311.

The thread element 310 comprise a track 313 extending along a part of the structured surface 311.

The bushing 320 has a substantially drop shaped cross-section, so as to match the shape of the bottom part of the support member channel of the lower ladder module.

In an assembled configuration of the tightening device, the bushing 320 and the nut 330 encircles the thread element 310.

The bushing 320 comprises a protrusion 323 extending from an inner surface as seen on figure 6C.

The protrusion 323 has a shape so as to match the track 313 of the thread element 310.

The track 313 and the protrusion 323 ensures that the bushing 320 stays on the thread element 310, since the track does not extend all the way to the end of the threaded surface, so that the treads at one end of the thread element blocks the protrusion of the bushing to move past said threads.

The nut 330 is screwed on the other side of the thread element so as

to ensure that the thread element cannot move past the nut and stays on the thread element.

The nut 330 comprises a threaded inner surface 335 so as to match the outer threaded surface 311 of the thread element 310.

5 The nut 330 is adapted to be screwed on the thread element 310.

In the assembled configuration of the modular safety ladder 1, the bushing 320 is arranged inside the lower part of the support member channel of the lower ladder module 700.

10 The connection member 400 extends through the thread element 310, wherein the tightening end 403 of the connection member is arranged so that it cannot move past (i.e. into) the end of said thread element that is arranged outside the support member channel.

The tightening end of the connection member is tied in a knot 403.

15 When the nut 330 is screwed one way, the thread element moves further into the support member channel and the modular safety ladder is loosened.

When the nut 330 is screwed the other way, the thread element moves further out of the support member channel, thus stretching the connection member and thereby tightening the modular safety ladder.

20 The tightening device further comprises an interlocking ratchet element such as inclined teeth 324, 334 between the bushing and the nut to make the nut one-way rotational.

25 When the nut is turned (by hand or alternatively with a hex-key) the thread element moves slowly straight out of the bottom part of support member channel of the lower ladder module, where the bushing prevents it from rotating. This causes the connection member to stretch, and the ladder modules of the modular safety ladder are pulled together, resulting in a tensioned, firm construction.

30 A protruding collar 336 on the nut 330 covers the gap between the nut and the bushing, thereby preventing fingers from a person operating the tightening device from getting pinched during operation.

The thread element has an inner cone-shaped hole that narrows towards the lower end of the through hole allowing the connection member to pass at the bottom.

The nut 330 further comprises a plurality of elongated protrusion so as to provide a better grip on the nut during operation.

Fig 7 show an exploded view of an attachment device according to a second aspect of the invention.

The attachment device 500 comprises a bracket 510 adapted to be attached to said desired structure and two clamps 520. Each clamp comprises a gripping part 521, said gripping part being shaped so as to be able to grip a part of the modular safety ladder having a structured surface 112, 122, and a base part 525 attached to said gripping part and adapted to be secured to said bracket via different attachment means here shown as bolts 512 and a back plate 530.

The bracket 510 has a u-shape with a back part 511 and opposite arranged, extending wings 513.

The gripping part 512 has a semi-circular shape and a structured inner surface 523, here shown as a threaded surface, so as to match and engage with the structured surface of the modular safety ladder 1.

The bracket may be installed on the surface of the construction where the modular safety ladder is to be mounted, such as a quay or wharf wall.

Each clamp may interlock with the support member of the modular safety ladder, and with the bracket, whereby said ladder is fixated to the wall both horizontally and vertically.

The modular construction of the modular safety ladder may allow to freely position the modular safety ladder on any desired angled point on the quay wall, making it possible to mount a modular safety ladder that is safe and durable in new positions, that have not been possible with the prior art modular safety ladders.

Turning to figure 1 which shows the modular safety ladder in the assembled configuration as it may look when it is mounted to a structure, it is in the following describe one way of assembling and attaching/mounting said

modular safety ladder to a structure.

Before installing the modular safety ladder, the attachment device 500 is mounted to said structure.

5 Brackets are mounted on the structure. They should preferably be positioned straight above each other with a spacing of up to 2 meters. The uppermost bracket should be positioned flush with the ground, as it may serve as protecting frame for the light device 600.

10 The lowermost bracket is mounted in the lowest possible position above water surface, as the ladder will be suspended from there and downwards (at least 1 meter below lowest water level).

Clamps are mounted on each side of the brackets, preferably using stainless steel hex screws.

15 To fix the modular safety ladder to the brackets, the clamps are opened by loosening the clamps' hex screws. The modular safety ladder is then positioned in the brackets (i.e. a part of the support member with a structured surface is arranged inside the gripping part of the clamp), and the hex screws are tightened, making the clamps fasten their grip around the modular safety ladder. The rippled surfaces of the inside of the clamps and a part of the modular safety ladder interlock, and the ladder is fixed vertically and horizontally.

20 The structured surface of the gripping part is shaped so as to substantially match the shape of said part of the modular safety ladder, so that the gripping part fixates the modular safety ladder, when the modular safety ladder is mounted to the attachment device.

25 To assemble the safety ladder 1 the desired number of ladder modules 100/700 and spacers are provided. This is illustrated in figures 1, 4 and 5.

30 The spacers 210, 220, 230, 240 are positioned to space apart the guide rail portions 110, 120 of the upper ladder module 100 from the guide rail portions 710, 720 of the lower ladder module 700, wherein at least a part of the spacers in the assembled configuration is positioned between a surface of the first guide rail portions of the upper ladder module and respective opposite surfaces of the first guide rail portions of the lower ladder module.

When the tightening device is activated, said ladder modules 100, 700

are pulled towards each other, so that said tightening of the tightening device squeezes or pinches or compresses said at least a part of the spacers between said surfaces.

5 Although some embodiments have been described and shown in detail, the invention is not restricted to them, but may also be embodied in other ways within the scope of the subject matter defined in the following claims. It is to be understood that other embodiments may be utilised and structural and functional modifications may be made without departing from the scope of the present invention.

10 In device claims enumerating several means, several of these means can be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims or described in different embodiments does not indicate that a combination of these measures cannot be used to advantage.

15 It should be emphasized that the term "comprises/comprising" when used in this specification is taken to specify the presence of stated features, integers, steps, or components but does not preclude the presence or addition of one or more other features, integers, steps, components, or groups thereof.

C L A I M S

1. A modular safety ladder comprising
 - a number of rungs (130) connecting a first and a second guide rail (10, 110, 20, 120), and
 - 5 an upper ladder module (100) and a lower ladder module (700), said modular safety ladder being able to be arranged in an un-assembled configuration, in which said upper ladder module (100) is un-attached to said lower ladder module (700), and an assembled configuration, in which said upper ladder module (100) is attached to said lower ladder module (700),
 - 10 wherein each ladder module (100, 700) comprises
 - a first and a second guide rail portion (10, 110, 20, 120), and
 - a rung (130) connecting the first and second guide rail portions (10, 110, 20, 120), and
 - a tightening device (300) which in the assembled configuration upon
 - 15 activation pulls said ladder modules (100, 700) towards each other,
 - c h a r a c t e r i z e d in that the modular safety ladder further comprises
 - a spacer (200, 210, 220, 230, 240), the spacer in the assembled configuration being positioned to space apart the first guide rail portion (10, 110)
 - 20 of the upper ladder module (100) from the first guide rail portion (10, 110) of the lower ladder module (700), wherein a collar part (217, 247) of the spacer (200, 210, 220, 230, 240) in the assembled configuration is positioned between a surface of the first guide rail portion (10, 110) of the upper ladder module (100) and an opposite surface of the first guide rail portion (10, 110) of the lower
 - 25 ladder module (700) so that tightening of the tightening device (300) will squeeze or pinch or compress said collar part (217, 247) of the spacer between said surfaces,
 - the spacer (210, 220, 230, 240) comprising an upper protrusion (243), wherein at least a part of the upper protrusion (243) is arranged in a first support
 - 30 member channel (113, 127) of the upper ladder module (100) when the modular safety ladder is arranged in the assembled configuration,
 - the spacer comprising a lower protrusion (245), wherein at least a part

of the lower protrusion (245) is arranged in a first support member channel (727) of the lower ladder module (700) when the modular safety ladder is arranged in the assembled configuration, and

the spacer (240) comprising the collar part (247), said lower and upper
5 protrusions (243, 245) extending in opposite directions away from said collar part (247).

2. A modular safety ladder according to claim 1, wherein the modular safety ladder further comprises a connection member (400) extending along the guide rail and connected to said tightening device (300).

10 3. A modular safety ladder according to claim 2, wherein the modular safety ladder comprises four connection members (400).

4. A modular safety ladder according to any one of the previous claims, wherein the spacer (200, 210, 220, 230, 240) comprises a through hole (241), the first guide rail portion (10, 110) comprises a first support member (111)
15 having the first support member channel (113) and the second guide rail portion (20, 120) comprises a third support member (121) having a third support member channel (123), so that when the modular safety ladder is arranged in the assembled configuration, the upper ladder module (100), the lower ladder module (700) and the spacer (200, 210, 220, 230, 240) is preferably strung on the
20 connection member (400) in the assembled configuration of the modular safety ladder.

5. A modular safety ladder according to any one of the previous claims, wherein the ladder module (100) is manufactured in one piece, preferably by injection moulding.

25 6. A modular safety ladder according to any one of the previous claims, wherein the first support member channel (113, 127) of the upper ladder module (100) and/or the first support member channel of the lower ladder module (700) have/has a substantially drop shaped cross-section, preferably the upper protrusion (241) and/or the lower protrusion (245) of said spacer (240)
30 have/has a substantially drop shaped cross-section, so as to match the shape of the first support member channel (113) and provide a frictional fit, when the protrusion is inserted into the channel in the assembled configuration of said

modular safety ladder.

7. A modular safety ladder according to any one of the previous claims, wherein the ladder module (100) is manufactured from at least 10 %, at least 20 %, at least 30 %, at least 40 %, at least 50 %, at least 60 %, at least 70 %, at least 80 %, at least 90 % or at least 95 % of polypropylene (PP), preferably glass reinforced polypropylene (PP), or polyamide (PA), preferably glass reinforced polyamide (PA).

8. A modular safety ladder according to any one of the previous claims, wherein the spacer (200, 210, 220, 230, 240) is manufactured from a material comprising at least 10 %, at least 20 %, at least 30 %, at least 40 %, at least 50 %, at least 60 %, at least 70 %, at least 80 %, at least 90 % or at least 95 % of a rubber material and/or a rubber compound and/or a material or a combination of materials selected from the group consisting of silicone, silicone rubber, natural rubber, synthetic rubber, TPE, PTFE, EPDM, HBNR, neoprene, polyethylene, polypropylene, HDPE, polystyrene and nylon/polyamide.

9. A modular safety ladder according to any one of the previous claims, wherein the first guide rail portion (110) comprises a first and a second support member (111, 115) preferably having a first and a second support member channel (113, 117), and/or the second guide rail portion (120) comprises a third and a fourth support member (121, 125) preferably having a third and a fourth support member channel (123, 127), and/or at least two spacers, preferably four spacers, (200, 210, 220, 230, 240).

10. A modular safety ladder according to any one of the previous claims, further comprising a plug (800) connected to the connection member (400), the plug, in the assembled configuration of the modular safety ladder, is arranged in the first support member channel (113) of the upper ladder module (100).

11. A modular safety ladder according to claim 10, wherein the plug (800) comprises a head (801) and a body (802) with a through hole (803), the body of said plug is preferably arranged in the upper part of the first support member channel (113).

12. A modular safety ladder according to any one of claims 10 - 11,

wherein a part of the plug (800), preferably the body (802) of said plug, has a substantially drop shaped cross-section, so as to match the shape of the first support member channel (113) and provide a snug fit, when said part is inserted into the support member channel in the assembled configuration of the modular safety ladder.

13. A modular safety ladder according to any one of the previous claims, wherein the tightening device (300) comprises a thread element (310), a through hole (315), a bushing (320) and a nut (330), the through hole preferably extending through the thread element, so that the connection member may extend through said through hole of the thread elements, when the modular safety ladder is in the assembled configuration.

14. A modular safety ladder set of parts comprising
a modular safety ladder according to any one of claims 1 to 13, and
preferably an attachment device comprising
a bracket (510) adapted to be attached to said desired structure,

a clamp (520), preferably two clamps, each clamp comprising a gripping part (521), said gripping part being shaped so as to be able to grip a part of the modular safety ladder having a structured surface (112, 122), and

a base part (525) attached to said gripping part (521) and adapted to be secured to said bracket (510),

wherein a structured surface of the gripping part (521) is shaped so as to substantially match the shape of said part of the modular safety ladder, so that the gripping part fixates the modular safety ladder, when the modular safety ladder is mounted to the attachment device.

15. Method for assembly of a modular safety ladder comprising the steps of

- providing said modular safety ladder according to any one of claims 1 – 13,

- positioning the spacer (200) to space apart the first guide rail portion of the upper ladder module (100) from the first guide rail portion of the lower

ladder module (700), wherein at least a part (247) of the spacer in the assembled configuration is positioned between a surface of the first guide rail portion of the upper ladder module (100) and an opposite surface of the first guide rail portion of the lower ladder module (700), and

- 5 - activating said tightening device (300) to pull said ladder modules towards each other, so that said tightening of the tightening device squeezes or pinches or compresses said at least a part (247) of the spacer between said surfaces.

16. Method for attaching the modular safety ladder according to any
10 one of claims 1 to 13 to a structure such as a quay or wharf by means of an attachment device, comprising the steps of

- providing said modular safety ladder according to any one of claims 1 - 13 having a ladder module with a structured surface,

 - providing said attachment device comprising
15 a bracket (510) adapted to be attached to said desired structure,

 a clamp (521), preferably two clamps, each clamp comprising a gripping part, said gripping part being shaped so as to be able to grip a part of the modular safety ladder having a structured surface (112, 122),
20 and

 a base part (525) attached to said gripping part (521) and adapted to be secured to said bracket,

 wherein a structured surface of the gripping part is shaped so as to substantially match the shape of said part of the modular safety ladder, so that the gripping part fixates the modular safety ladder, when
25 the modular safety ladder is mounted to the attachment device,

- attaching the bracket on said structure,
 - attaching two clamps on opposite sides of the bracket,
 - positioning the ladder module so that a part of the support member
30 with a structured surface is arranged inside the gripping part of the clamp, and
 - tightening the clamps, so that the as to secure the ladder module in a fixed position,

wherein a structured surface of the gripping part is shaped so as to substantially match the shape of said part of the modular safety ladder, so that the gripping part fixates the modular safety ladder, when the modular safety ladder is mounted to the attachment device.

5 17. A tightening device set of parts for tightening an upper ladder module (100) and a lower ladder module (700), said modules being able to be arranged in an un-assembled configuration, in which said upper ladder module is un-attached to said lower ladder module, and an assembled configuration, in which said upper ladder module is attached to said lower ladder module, the
10 tightening device set of parts comprising:

 the upper ladder module (100) and the lower ladder module (700), said modules being able to be arranged in an un-assembled configuration, in which said upper ladder module is un-attached to said lower ladder module, and an assembled configuration, in which said upper ladder module is attached to said
15 lower ladder module;

 a tightening device (300);

 a connection member (400) extending along the modules and connected to said tightening device;

 a spacer (200), the spacer in the assembled configuration being positioned to space apart the modules the spacer comprising an upper protrusion (243), wherein at least a part of the upper protrusion (243) is arranged in said first support member channel (113, 127) of the upper ladder module (100) when the modular safety ladder is arranged in the assembled configuration, the spacer comprising a lower protrusion (245), wherein at least a part of the lower
20 protrusion (245) is arranged in said first support member channel (727) of the lower ladder module (700) when the modular safety ladder is arranged in the assembled configuration, and the spacer (240) comprising a collar part (247), said lower and upper protrusions (243, 245) extending in opposite directions away from said collar part (247);
25

30 wherein the tightening device (300) in the assembled configuration upon activation pulls said ladder modules towards each other, wherein the col-

lar part (247) of the spacer in the assembled configuration is positioned between a surface of the upper ladder module (100) and an opposite surface of the lower ladder module (700) so that tightening of the tightening device (300) will squeeze or pinch or compress said collar part (247) of the spacer between
5 said surfaces.