ROPE GRAB

BACKGROUND

[0001] Regulations typically require workers who work at heights to don a safety harness that is coupled to a support structure so that if a fall event occurs, the fall is limited, therein reducing the chances of injuries to the worker. Systems that protect workers during fall events that can occur while climbing or descending on structures such as ladders and the like can be a challenge because of the varying vertical locations of the worker in relation to a support structure.

[0002] For the reasons stated above and for other reasons stated below which will become apparent to those skilled in the art upon reading and understanding the present specification, there is a need in the art for an effective and efficient rope grab system that includes a rope grab and a generally vertically placed elongated member that is used as a support structure.

SUMMARY OF INVENTION

[0003] The above-mentioned problems of current systems are addressed by embodiments of the present invention and will be understood by reading and studying the following specification. The following summary is made by way of example and not by way of limitation. It is merely provided to aid the reader in understanding some of the aspects of the invention.

[0004] In one embodiment, there is provided a rope grab comprising:

a housing having ~~having~~ an elongated member guide forming an elongated member passage, the elongated member passage configured and arranged to receive an elongated member;

a locking cam pivotally coupled to the housing, the locking cam configured and arranged to selectively engage an elongated member received in the elongated member passage;

a cam biasing member positioned to provide a relatively slight biasing force on the locking cam towards an elongated member received in the elongated member passage, the relatively slight biasing force being countered by gravity during normal operations of the rope grab to allow the rope grab to move both up and down on the elongated member without the locking cam locking onto the elongated member during normal operations while inertial loads on the locking cam and the slight biasing force of the cam biasing member during a fall event

work in tandem to rotate the locking cam onto the elongated member to lock the locking cam onto the elongated member in the elongated member passage; ~~and~~

a locking arm pivotally coupled to the housing, the locking arm having a first end configured and arranged to be coupled to a safety harness of a user and a second end configured and arranged to selectively engage the locking cam to selectively lock the locking cam onto the elongated member in the elongated member passage during a fall event;

a rotating side plate pivotally coupled to the housing to selectively block a side opening to the elongated member passage of the housing;

at least one lever; and

a lock member coupled to rotate in response to the rotation of the at least one lever, the lock member configured and arranged to selectively engage the rotating side plate to lock the rotating side plate in a static position in relation to the housing to selectively block at least a portion of the side opening to the elongated passage.

[0005] In another embodiment, ~~another rope grab is~~there is provided a rope grab comprising: ~~. The rope grab of this embodiment includes a housing, a locking cam and a locking arm. The housing has an elongated member guide that forms an elongated member passage. The elongated member passage is configured and arranged to receive an elongated member. The locking cam is pivotally coupled to the housing. The locking cam is configured and arranged to selectively engage an elongated member received in the elongated member passage. The locking cam has a radial edge that is configured and arranged to engage the elongated member. The radial edge having a curvature that varies in relation to a pivot connection to the housing so that the radial edge engages each elongated member at a contact angle that is the same even when different diameter elongated members are received in the elongated member passage of the housing. The locking arm is pivotally coupled to the housing. The locking arm has a first end that is configured and arranged to be coupled to a safety harness of a user and a second end that is configured and arranged to selectively engage the locking cam to lock the locking cam on an elongated member during a fall event~~

a housing having an elongated member guide forming an elongated member passage, the elongated member passage configured and arranged to receive an elongated member;

a locking cam pivotally coupled to the housing, the locking cam configured and arranged to selectively engage an elongated member received in the elongated member passage, the locking cam having a radial edge that is configured and arranged to engage the elongated member, the radial edge having a curvature that varies in relation to a pivot connection to the housing so that the radial edge engages each elongated member at a contact angle that is the same even when different diameter elongated members are received in the elongated member passage of the housing;

a locking arm pivotally coupled to the housing, the locking arm having a first end configured and arranged to be coupled to a safety harness of a user and a second end configured and arranged to selectively engage the locking cam to lock the locking cam on an elongated member during a fall event;

a fixed side plate coupled to the housing, the locking cam, the locking arm and the rotating side plate positioned between the fixed side plate and the housing;

a spring spacer positioned between the locking arm and the fixed plate, the spacer having a spring holding slot formed in an end of the spacer; and

an arm spring having a first end portion, a second end portion and a coiled portion positioned in between the first end portion and the second end portion, the coiled portion received around the spring spacer, the first end portion of the arm spring received in the spring

holding slot of the spring spacer, the first end portion of the arm spring further engaging a portion of the housing, the second end portion of the arm spring engaging the locking arm to provide a biasing force on the locking arm.

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[0006] In another embodiment, there is provided a rope grab system comprising:

at least one bypass bracket configured and arranged to couple an elongated member to a support structure; and a rope grab including,

a housing having an elongated member guide forming an elongated member passage, the elongated member passage configured and arranged to pass an elongated member and a portion of the at least one bypass bracket there through,

a locking cam pivotally coupled to the housing, the locking cam configured and arranged to selectively engage one of the elongated member and the portion of the at least one bypass bracket,

a cam spring coupled between the housing and the locking cam to provide a relatively slight biasing force on the locking cam towards the elongated member and the portion of the at least one bracket received in the elongated member passage, the relatively slight biasing force being countered by gravity during normal operations of the rope grab to allow the rope grab to move both up and down on the elongated member without the locking cam locking on the elongated member during normal operations while inertial loads on the locking cam and the slight biasing force of the cam biasing member during a fall event work in tandem to rotate the locking cam onto the elongated member to lock the locking cam onto the elongated member in the elongated member passage; ~~and~~

a locking arm pivotally coupled to the housing, the locking arm having a first end configured and arranged to be coupled to a safety harness of a user and a second end configured and arranged to selectively engage the locking cam to selectively lock the locking cam on the elongated member in the elongated member passage during a fall event;

a fixed side plate coupled to the housing, the locking cam, the locking arm and the rotating side plate positioned between the fixed side plate and the housing;

a spring spacer positioned between the locking arm and the fixed plate, the spacer having a spring holding slot formed in an end of the spacer; and

an arm spring having a first end portion, a second end portion and a coiled portion positioned in between the first end portion and the second end portion, the coiled portion received around the spring spacer, the first end portion of the arm spring received in the spring holding slot of the spring spacer, the first end portion of the arm spring further engaging a portion of the housing, the second end portion of the arm spring engaging the locking arm to provide a biasing force on the locking arm.

[0007] ~~In still further another embodiment,~~ There is also disclosed a method of manipulating a rope grab ~~is provided~~. The method includes rotating a lever rotationally coupled to a housing to release a rotating side plate with a hand of a user; pulling back on an end of the rotating side plate to pivot a portion of the rotating side plate away from a side opening to an elongated member passage formed in the housing with the hand of the user; positioning the rope grab to receive an elongated member within the elongated member passage of the housing with the hand of the

CLAIMS

1. A rope grab comprising:

a housing having an elongated member guide forming an elongated member passage, the elongated member passage configured and arranged to receive an elongated member;

a locking cam pivotally coupled to the housing, the locking cam configured and arranged to selectively engage an elongated member received in the elongated member passage;

a cam biasing member positioned to provide a relatively slight biasing force on the locking cam towards an elongated member received in the elongated member passage, the relatively slight biasing force being countered by gravity during normal operations of the rope grab to allow the rope grab to move both up and down on the elongated member without the locking cam locking onto the elongated member during normal operations while inertial loads on the locking cam and the slight biasing force of the cam biasing member during a fall event work in tandem to rotate the locking cam onto the elongated member to lock the locking cam onto the elongated member in the elongated member passage; ~~and~~

a locking arm pivotally coupled to the housing, the locking arm having a first end configured and arranged to be coupled to a safety harness of a user and a second end configured and arranged to selectively engage the locking cam to selectively lock the locking cam onto the elongated member in the elongated member passage during a fall event;

a rotating side plate pivotally coupled to the housing to selectively block a side opening to the elongated member passage of the housing;

at least one lever; and

a lock member coupled to rotate in response to the rotation of the at least one lever, the lock member configured and arranged to selectively engage the rotating side plate to lock the rotating side plate in a static position in relation to the housing to selectively block at least a portion of the side opening to the elongated passage.

~~2. The rope grab of claim 1, further comprising:~~

~~a rotating side plate pivotally coupled to the housing to selectively block a side opening to the elongated member passage of the housing.~~

~~3~~2. The rope grab of claim ~~2~~1, further comprising:

a fixed side plate coupled to the housing, the locking cam, the locking arm and the rotating side plate positioned between the fixed side plate and the housing.

43. The rope grab of claim 1, further comprising:

the locking cam having a radial edge that is configured and arranged to engage an elongated member, the radial edge having a curvature that varies in relation to a pivot connection to the housing so that the radial edge engages each elongated member at an contact angle that is the same even when different diameter elongated members are received in the elongated member passage of the housing.

54. The rope grab of claim 1, further comprising:

a fixed side plate coupled to the housing, the locking cam, the locking arm and the rotating side plate positioned between the fixed side plate and the housing;

a spring spacer positioned between the locking arm and the fixed plate, the spacer having a spring holding slot formed in an end of the spacer; and

an arm spring having a first end portion, a second end portion and a coiled portion positioned in between the first end portion and the second end portion, the coiled portion received around the spring spacer, the first end portion of the arm spring received in the spring holding slot of the spring spacer, the first end portion of the arm spring further engaging a portion of the housing, the second end portion of the arm spring engaging the locking arm to provide a biasing force on the locking arm.

65. The rope grab of claim 54, wherein the housing includes a post with a cut out section, the spring spacer having a central passage, the post of the housing received in the central passage and the first end portion of the arm spring received in the cut out section of the post to engage the first end portion of the arm spring to the housing.

76. The rope grab of claim 21, further comprising:

at least one roller coupled proximate an end of the rotating side plate, the at least one roller configured to guide an elongated member through the elongated member passage.

87. The rope grab of claim 21, further comprising:

a side plate spring coupled between the housing and the rotating side plate to provide a biasing force on the rotating side plate.

98. The rope grab of claim 21, further comprising;

~~at least one lever;~~

a lever spring coupled between the housing and the at least one lever to provide a biasing force on the at least one lever;

~~a lock member coupled to rotate in response to the rotation of the at least one lever, the lock member configured and arranged to selectively engage the rotating side plate to lock the~~

~~rotating side plate in a static position in relation to the housing to selectively block at least a portion of the side opening to the elongated passage;~~ and

a lock spring coupled between the housing and the rotating side plate to provide a biasing force on the rotating side plate.

~~10~~9. The rope grab of claim ~~9~~8, further comprising:

the lever extending through a slot in the housing.

~~11~~10. The rope grab of claim 1, wherein the locking arm includes an energy absorbing portion configured and arranged to absorb energy during a fall event.

~~12~~11. A rope grab comprising:

a housing having an elongated member guide forming an elongated member passage, the elongated member passage configured and arranged to receive an elongated member;

a locking cam pivotally coupled to the housing, the locking cam configured and arranged to selectively engage an elongated member received in the elongated member passage, the locking cam having a radial edge that is configured and arranged to engage the elongated member, the radial edge having a curvature that varies in relation to a pivot connection to the housing so that the radial edge engages each elongated member at a contact angle that is the same even when different diameter elongated members are received in the elongated member passage of the housing; ~~and~~

a locking arm pivotally coupled to the housing, the locking arm having a first end configured and arranged to be coupled to a safety harness of a user and a second end configured and arranged to selectively engage the locking cam to lock the locking cam on an elongated member during a fall event;

a fixed side plate coupled to the housing, the locking cam, the locking arm and the rotating side plate positioned between the fixed side plate and the housing;

a spring spacer positioned between the locking arm and the fixed plate, the spacer having a spring holding slot formed in an end of the spacer; and

an arm spring having a first end portion, a second end portion and a coiled portion positioned in between the first end portion and the second end portion, the coiled portion received around the spring spacer, the first end portion of the arm spring received in the spring holding slot of the spring spacer, the first end portion of the arm spring further

engaging a portion of the housing, the second end portion of the arm spring engaging the locking arm to provide a biasing force on the locking arm.

~~13~~12. The rope grab of claim ~~12~~11, further comprising:

a rotating side plate pivotally coupled to the housing to selectively block at least a portion of a side opening to the elongated member passage of the housing to selectively retain an elongated member within the elongated member passage.

~~14~~13. The rope grab of claim ~~12~~11, further comprising:

a cam spring coupled between the housing and the locking cam to provide a relatively slight biasing force on the locking cam in a direction towards an elongated member received in the elongated member passage, the relatively slight biasing force being countered by gravity to allow the rope grab to move both up and down on the elongated member without the locking cam locking on the elongated member during normal operations while causing the locking cam to lock onto the elongated member during a fall event.

~~15. The rope grab of claim 12, further comprising:~~

~~a fixed side plate coupled to the housing, the locking cam, the locking arm and the rotating side plate positioned between the fixed side plate and the housing;~~

~~a spring spacer positioned between the locking arm and the fixed plate, the spacer having a spring holding slot formed in an end of the spacer; and~~

~~an arm spring having a first end portion, a second end portion and a coiled portion positioned in between the first end portion and the second end portion, the coiled portion received around the spring spacer, the first end portion of the arm spring received in the spring holding slot of the spring spacer, the first end portion of the arm spring further engaging a portion of the housing, the second end portion of the arm spring engaging the locking arm to provide a biasing force on the locking arm.~~

~~16~~14. The rope grab of claim ~~13~~12, further comprising:

at least one roller coupled proximate an end of the rotating side plate, the roller configured to guide an elongated member through the elongated member passage.

~~17~~15. The rope grab of claim ~~13~~12, further comprising:

at least one lever;

a lock member coupled to rotate in response to the rotation of the at least one lever, the lock member configured and arranged to selectively engage the rotating side plate to lock the rotating side plate in a static position in relation to the housing to selectively block at least a portion of the side opening to the elongated passage;

a lock spring coupled between the housing and the rotating side plate to provide a biasing force on the rotating side plate; and

a lever spring coupled between the housing and the at least one lever to provide a biasing force on the at least one lever.

~~18~~16. The rope grab of claim ~~12~~11, wherein the locking arm includes an energy absorbing portion configured and arranged to absorb energy during a fall event.

~~19~~17. A rope grab system comprising:

at least one bypass bracket configured and arranged to couple an elongated member to a support structure; and

a rope grab including,

a housing having an elongated member guide forming an elongated member passage, the elongated member passage configured and arranged to pass an elongated member and a portion of the at least one bypass bracket there through,

a locking cam pivotally coupled to the housing, the locking cam configured and arranged to selectively engage one of the elongated member and the portion of the at least one bypass bracket, a cam spring coupled between the housing and the locking cam to provide a relatively slight biasing force on the locking cam towards the elongated member and the portion of the at least one bracket received in the elongated member passage, the relatively slight biasing force being countered by gravity during normal operations of the rope grab to allow the rope grab to move both up and down on the elongated member without the locking cam locking on the elongated member during normal operations while inertial loads on the locking cam and the slight biasing force of the cam biasing member during a fall event work in tandem to rotate the locking cam onto the elongated member to lock the locking cam onto the elongated member in the elongated member passage; ~~and~~

a locking arm pivotally coupled to the housing, the locking arm having a first end configured and arranged to be coupled to a safety harness of a user and a second end configured and arranged to selectively engage the locking cam to selectively lock the locking cam on the elongated member in the elongated member passage during a fall event;

a fixed side plate coupled to the housing, the locking cam, the locking arm and the rotating side plate positioned between the fixed side plate and the housing;

a spring spacer positioned between the locking arm and the fixed plate, the spacer having a spring holding slot formed in an end of the spacer; and

an arm spring having a first end portion, a second end portion and a coiled portion positioned in between the first end portion and the second end portion, the coiled portion received around the spring spacer, the first end portion of the arm spring received in the spring holding slot of the spring spacer, the first end portion of the arm spring further engaging a portion of the housing, the second end portion of the arm spring engaging the locking arm to provide a biasing force on the locking arm.

~~20~~18. The rope grab system of claim ~~19~~17, wherein the bypass bracket further comprises:

a base bracket configured and arranged to be coupled to the support structure;

a sleeve clip coupled to the base bracket, the sleeve clip including spaced opposably faced first and second holding ears; and

a tubular sleeve having a central passage and spaced first and second opposably positioned recesses formed in an outer surface of the sleeve, the first and second holding ears of the sleeve clip configured and arranged to selectively receive the respective first and second opposably positioned recess of the tubular sleeve.

~~21. A method of manipulating a rope grab, the method comprising:~~

~~rotating a lever rotationally coupled to a housing to release a rotating side plate with a hand of a user;~~

~~pulling back on an end of the rotating side plate to pivot a portion of the rotating side plate away from a side opening to an elongated member passage formed in the housing with the hand of the user;~~

~~positioning the rope grab to receive an elongated member within the elongated member passage of the housing with the hand of the user; and~~

~~releasing the rotating side plate to allow the rotating side plate to at least partially cover the side opening to the elongated member passage of the housing to retain the elongated member with the elongated member passage.~~

~~22. The method of claim 21, further comprising:~~

~~rotating a lever rotationally coupled to a housing to release a rotating side plate with a hand of the user;~~

~~pulling back on an end of the rotating side plate to pivot a portion of the rotating side plate away from a side opening to an elongated member passage formed in the housing with the hand of the user;~~

~~removing the elongated member from the elongated member passage of the housing with the hand of the user; and~~

~~releasing the rotating side plate to allow the rotating side plate to at least partially cover the side opening to the elongated member passage of the housing.~~