

Description

[0001] The present invention relates to a ladder-restraining device for stabilising and restraining a ladder.

[0002] It is common to use a ladder to access elevated positions, in particular for repair or maintenance, or during a construction project. However there is a safety risk to the user of the ladder if the ladder is not restrained, that is, if the ladder is not held in position at the structure against which it is leaning, as the ladder may move or slip at the top and fall resulting in injury to the user, or to persons or property nearby. Movement of the ladder may occur for a number of reasons, including, for example, the ladder slipping at the base, the ladder peeling away at the top where it is leaning against a surface, the ladder twisting on an uneven surface, the ladder sliding along the surface against which it is positioned, the ladder sinking into the surface upon which it is standing, or the ladder moving in response to movement on the ladder of the user, say carrying a heavy load or leaning too far to one side.

[0003] Given the increasing incidents of injuries to employees resulting from unrestrained ladders, the Health and Safety Executive now require ladders to be restrained in position, at least in commercial situations, such as the construction industry.

[0004] Currently ladders are often simply placed in position and lashed with a rope near the top of the ladder. The lashing of ladders is common on scaffolding. Typically this requires the user to climb the unsecured ladder in order to lash the ladder into position. This is likely to be illegal unless undertaken by a scaffolder. Over time the rope becomes worn and can actually wear away, also the rope can slip on the surface to which it is lashed allowing the ladder to move.

[0005] Other known mechanisms to restrain or stabilise a ladder include stabilisers used to support a ladder at its base, these rely on friction to prevent substantial ladder movement. Another known device supports a ladder over guttering, and typically comprises some sort of hook, intended to space the ladder from the guttering thereby preventing the ladder from damaging the guttering.

[0006] According to a first aspect, the present invention provides a ladder-restraining device for restraining a ladder to a structure, comprising a mounting means for mounting the ladder-restraining device to the structure, a first enclosing member and a second enclosing member, said second enclosing member being movable relative to the first enclosing member, the ladder restraining device having an open condition wherein the first and second enclosing members define an opening adapted to allow a rung of a ladder to enter said opening, and a closed condition wherein said opening is reduced or eliminated and wherein said first and second enclosing members together form an enclosure which is adapted, in use, to at least partially enclose a rung of a ladder and retain the rung in the enclosure.

[0007] The term 'partially enclosed' preferably means that when the ladder-restraining device is in the closed condition and a rung of a ladder is located in the ladder-restraining device, the rung of the ladder cannot be removed from the ladder-restraining device. The first and second enclosing members may extend around the entire circumference of at least a part of the rung, or they may extend around enough of the circumference of the rung to prevent the rung from being removed from the ladder-restraining device when in the closed condition. When the rung is fully enclosed by the enclosing members the enclosing members may overlap.

[0008] Preferably, the ladder-restraining device is configured, and of a size, such that when in the closed condition and the rung of a ladder is located therein, there is no clearance, or only a small clearance, between the outer circumference of the rung and the enclosing members, say some about 1mm to about 20mm. The rung may be square or rectangular in cross section, rather than round, in which case the clearance between the edge of the rung and the enclosing members may be between 1mm and 20mm. Preferably, there is up to only about 30mm to about 40 mm between the enclosing members of the ladder-restraining device and the side members of the ladder. This relatively small gap between the enclosing members and side members of the ladder prevents any significant lateral movement of the ladder relative to the ladder-restraining device.

[0009] Preferably, the ladder-restraining device is arranged to require the application of force to move from the closed condition to the open condition. Preferably, the ladder-restraining device is arranged to require force to be applied to the second enclosing member in order for the device to adopt the open condition. The ladder-restraining device may be arranged to be biased to the closed position, for example, by gravity, and may be arranged such that the second member is movable from the open condition to the closed condition by gravity.

[0010] Preferably the second enclosing member comprises a pivoted jaw having a retaining formation to one side of a pivot point and an opening lever to the other side, and whereby the centre of gravity is such that the jaw is biased closed by gravity and can be pulled open by pulling on the lever.

[0011] Preferably the ladder-restraining device is configured with means to allow a user to move the second enclosing member, or operate the lever of the second enclosing member, from a remote position. More preferably these means are arranged to allow the user to move the second enclosing member from a position below the second enclosing member. Preferably, the second enclosing member is movable from a position at the foot of a ladder to be restrained by the ladder-restraining device. The means to move the second enclosing members may comprise an elongate force-transmission coupling such as a rope, chain, cord, cable or rod arranged to be attached to the second enclosing member. The elongate force-transmission coupling may comprise an

attachment structure, such as a hook or a clip with which to attach the coupling to the second enclosing member. The attachment structure may attach to the second enclosing member through a specific hole or by hooking or clipping to a part of the device. Alternatively, the coupling may be actually attached to the second enclosing member.

[0012] The means to move the second enclosing member may alternatively be a pole or stick, or indeed the ladder itself, which can be operated from below to apply a force to, and thereby move, the second enclosing member.

[0013] Preferably, the ladder-restraining device is arranged to retain a rung towards the top of a ladder.

[0014] Preferably the first and second enclosing members of the ladder-restraining device are connected by a connecting means.

[0015] The connecting means may be a pivotal connection. The pivotal connection may be arranged so that the second enclosing member is movable about a pivot between the closed condition and the open condition. The connecting means may be a nut and bolt, or a pin arrangement. The longitudinal axis of the bolt or pin may define the pivot axis.

[0016] Alternatively, the connecting means may be a sliding means arranged to allow the second enclosing member to slide relative the first enclosing member. The sliding means may be arranged to allow the second enclosing member to slide vertically relative to the first enclosing member.

[0017] Preferably the ladder-restraining device does not comprise any springs. More preferably, the ladder-restraining device does not comprise any latches.

[0018] The configuration of the ladder-restraining device is preferably simple and requires little maintenance. Other known ladder restraining devices employ complex systems, including, for example, springs and latches, which are prone to damage or to seizure, in particular if left exposed to the environment, thus requiring significant maintenance.

[0019] The first and the second enclosing members may be arranged, in use, relative to the ladder rung as a lower and an upper member respectively. Preferably the second or upper enclosing member is movable relative to the first or lower enclosing member.

[0020] Preferably the second/upper enclosing member is arranged to pivot about the axis defined by the one or more connecting means, such as pin or bolt, which hold the first/lower and second/upper enclosing members together.

[0021] The second/upper enclosing member may comprise a plate member which may be arranged to form a step when the ladder-restraining device is in use and in the closed position. The plate member may be arranged to overlay the enclosed ladder rung. The plate member may have a non-slip/textured surface.

[0022] In use, the ladder-restraining device may at least partially enclose the ladder rung along substantial-

ly the entire length of the rung, or only a part of the length. Preferably, in use, the ladder-restraining device at least partially encloses the rung at two points, these two points being located at substantially opposite ends of the rung.

[0023] At least one of the first or second enclosing members may comprise a recess which is arranged to form part of the enclosure, which, in use, accommodates the rung of a ladder. The recess may be U-shaped.

[0024] The ladder-restraining device may be made from galvanised steel. The device thus is preferably essentially rust free.

[0025] The ladder-restraining device may also comprise means to secure the enclosing members closed. The means to secure the enclosing members closed may be configured as first and second locking components adapted to be held together by a lock when the ladder-restraining device is in the closed condition. The lock may be a padlock or a combination lock. The locking components may be a first and a second hole, the first hole being located in the first enclosing member and the second hole being located in the second enclosing member. The ladder-restraining device may be arranged such that when in the closed condition the first and second enclosing members overlap and the securing holes located therein become aligned and a lock or other securing device can pass through the holes and be locked. When a padlock or a securing means is located in the aligned holes, and locked, the ladder-restraining device cannot be opened.

[0026] Alternatively, the means to secure the enclosing members closed may comprise a hole in the second enclosing member which when the device is in the closed position is positioned such that a lock can be located in the hole to prevent opening of the device. The lock may be configured as a pin or a padlock or a combination lock.

[0027] The securing of the ladder-restraining device in the closed condition in use will reduce theft of unattended ladders, as the ladder-restraining device cannot be opened and the ladders cannot be removed without first unlocking the securing means.

[0028] It is not unknown for telephone engineers, for example, to take down their ladders whilst they leave a telegraph pole in order to test the line at a remote location, for fear of having their ladder stolen. This is time consuming and awkward to have to keep putting unattended ladders in the back of a van for security.

[0029] The device may also comprise means for reducing lateral movement of a ladder rung located in the device, and thus reducing lateral movement of the whole ladder. The means for reducing lateral movement of the ladder rung may be arranged to effect the movement of the second enclosing member towards the first enclosing member so that a ladder rung located in the device is gripped or clamped by the first and second enclosing members.

[0030] Alternatively, the means for reducing lateral movement of the ladder rung may be arranged as a separate clamping means, distinct from the enclosing members, the clamping means being arranged to clamp a ladder rung once positioned in use in a ladder-restraining device according to the invention.

[0031] Preferably the means for reducing lateral movement of the ladder rung is actuated by a person using manual force whilst on the ladder which has been restrained in the ladder-restraining device.

[0032] Without the means for reducing lateral movement the ladder is secured in a substantially vertical position but some lateral movement of the ladder can still occur, particularly if the length of the rung is significantly greater than the length of the device.

[0033] Preferably the device is arranged to reduce lateral movement of ladder rungs of varying cross section and size, for example, round and rectangular cross section.

[0034] Preferably the means for reducing lateral movement is arranged in use to draw the first and second enclosing members together around a ladder rung located in the ladder-restraining device. The means may comprise a threaded locking bolt attached to the first enclosing member, which is arranged to be moveable to contact the second enclosing member and draw the first and second enclosing members together. As the members are drawn together they are arranged to clamp the ladder rung and reduce lateral movement of the rung. The threaded locking bolt may also be used to secure the device in the closed condition. The thread locking bolt may be arranged such that when the device is in the closed condition and the threaded locking bolt is arranged to contact the second enclosing member the device is secured in the closed condition until the bolt is released or undone. The bolt may be arranged such that it can be locked when the device is in the closed condition, and can only be released using a key or other specialised tool.

[0035] According to another aspect, the invention provides a ladder-restraining assembly comprising a ladder-restraining device according to the first aspect of the invention mounted on a carriage which is movable along a rail or guide.

[0036] Preferably, the carriage comprises a lock and release mechanism which allows the carriage to be releasably anchored at different positions along the rail or guide.

[0037] Preferably, the rail or guide is arranged to be mounted on a surface where it is desirable to be able to position the ladder-restraining device at more than one position, for example on or near the guttering of a building where maintenance of the guttering would require a ladder to be moved along the length of the guttering.

[0038] Preferably, a ladder-restraining device is located on or near a gutter. More preferably, a ladder-restraining device is located near a down pipe. Location near a down pipe will allow maintenance of the guttering

to remove blockages which commonly occur near the down pipe, for example due to the collection of fallen leaves.

[0039] When designing a building the location of ladder-restraining devices may be pre-planned, taking into the consideration the maintenance requirements of the building. That is, ladder attachment points in the form of ladder-restraining devices can be pre-installed where they will be needed in the future. This may assist an architect in meeting his requirements to consider the maintenance requirements of any structure he designs. For example, the bracket for a security light or surveillance camera could be provided with a ladder-restraining device pre-mounted thereon. Thus when attaching a bracket on a wall or structure for something that will need maintenance, a ladder-restraining device can also be incorporated in the bracket at the same time.

[0040] According to another aspect, the invention provides a scaffold pole with a ladder-restraining device attached thereto, wherein the ladder-restraining device comprises a mounting means for mounting the ladder-restraining device to the scaffold pole, a first enclosing member and a second enclosing member, said second enclosing member being movable relative to the first enclosing member, the ladder restraining device having an open condition wherein the first and second enclosing members define an opening adapted to allow a rung of a ladder to enter said opening, and a closed condition wherein said opening is reduced or eliminated and wherein said first and second enclosing members together form an enclosure which is adapted, in use, to at least partially enclose a rung of a ladder and retain the rung in the enclosure.

[0041] According to yet another aspect, the invention provides a method of restraining a ladder using a ladder-restraining device having a first enclosing member and a second enclosing member, said second enclosing member being movable relative to the first enclosing member to move the ladder-restraining device between an open condition and a closed condition, the method comprising the steps of passing a rung of a ladder through an opening defined by the first and second enclosing members when the ladder-restraining device is arranged in the open condition, moving the second enclosing member to bring the ladder-restraining device into the closed condition, reducing or eliminating the opening and at least partially enclosing the rung of the ladder with the first and second enclosing members, thereby retaining the ladder rung and restraining movement of the ladder.

[0042] The rung of the ladder may be completely enclosed by the first and second enclosing members.

[0043] Preferably the method comprises moving the second enclosing member into the open condition before passing the rung of the ladder into the ladder-restraining device.

[0044] Preferably the moving of the ladder-restraining device into the open condition is effected from below the

ladder-restraining device, possibly from the ground. More preferably, opening of the ladder-restraining device is effected from the foot of the ladder which is to be located in the ladder-restraining device. The user of the ladder therefore does not have to climb the ladder before it is restrained.

[0045] Preferably the ladder-restraining device is opened by using an elongate force-transmission means to apply a force to the second enclosing member.

[0046] The elongate force-transmission means may be configured as a rope, chain, cable, cord or rod arranged to be attached to the second enclosing member. The elongate force-transmission means may be pulled to move the second enclosing means and open the ladder-restraining device to the open condition. Alternatively, the elongate force-transmission means may be a pole or stick, or the ladder itself, which can be used to push or pull the second enclosing means to open the ladder-restraining device to the open condition.

[0047] Preferably, the method comprises the step of allowing the ladder-restraining device to close by gravity. The centre of gravity of the second enclosing member may be such that the ladder-restraining device is biased to the closed condition. Thus when no force is applied to the second enclosing member it will move to the closed condition.

[0048] The first and second enclosing members may be pivotally connected. Moving the second enclosing member between the open condition and the closed condition may be effected by pivoting the second enclosing member about the pivotal connection. The application of a force to the second enclosing member may result in the second member pivoting about the pivotal connection into the open condition.

[0049] Alternatively, the first and second enclosing members may be slidably connected. Moving the second enclosing member between the open condition and the closed condition may be effected by sliding the second enclosing member relative to the first enclosing member. The application of a force to the second enclosing member may result in the second member sliding into the open condition.

[0050] The method may comprise the step of locking the ladder-restraining device in the closed position once the ladder rung has been retained therein. The ladder-restraining device may be locked by inserting a securing means through two holes, one in the first enclosing member and the other in the second enclosing member, which are aligned when the ladder-restraining device is in the closed condition. The securing means may be padlock.

[0051] Preferably the method also comprises clamping the ladder rung in the device to reduce lateral movement of the ladder rung. Preferably the ladder rung is clamped in a position of use after it has been restrained in the ladder-restraining device. Clamping of the ladder rung may be achieved by actuating means for reducing lateral movement of the ladder rung. The means for re-

ducing lateral movement of the ladder may include the enclosing members or may be configured as a separate clamping means. The ladder rung may be clamped by drawing the enclosing members closer together to clamp the ladder rung thereby reducing lateral movement of the ladder rung in the device. The drawing together of the first and second enclosing members may be achieved, for example, by using a threaded locking bolt mounted on the first enclosing member which is rotatable in a complementary threaded guide on first enclosing member to contact with the second enclosing member thereby effecting the drawing together of the first and second enclosing members such that they clamp the ladder rung to reduce lateral movement.

[0052] Alternatively, the ladder rung may be clamped in position in the ladder-restraining device by clamping means distinct from the enclosing members.

[0053] Preferably the clamping means, or the means to draw the enclosing members closer together to clamp the ladder rung, is manually applied, and preferably has a degree of mechanical advantage, preferably at least 5, 10 or 20, or more.

[0054] Preferably the clamping means, or the means to draw the enclosing members closer, is operated from a position at the ladder clamp once the ladder has been restrained in the ladder-restraining device.

[0055] Preferably, the method of restraining the ladder also includes a step of clamping the ladder rung to reduce lateral move. Preferably the method comprises two steps, a first step of restraining a ladder rung in the ladder-restraining device, and a second step of clamping the ladder rung in the ladder-restraining device to reduce lateral movement.

[0056] According to a yet further aspect, the invention provides a method of removing a ladder from a ladder-restraining device when a rung of the ladder is retained therein, said the ladder-restraining device having a first enclosing member and a second enclosing member, said second enclosing member being movable relative to the first enclosing member to move the ladder-restraining device between an open condition and a closed condition, the enclosing members defining an enclosure which at least partially encloses the rung of a ladder in the closed condition, the method comprising the steps of opening the ladder-restraining device by moving the second enclosing member relative to the first enclosing member into the open condition and removing the rung of the ladder from the ladder-restraining device.

[0057] Preferably when the ladder-restraining device is moved into the open condition the first and second enclosing members define an opening through which the rung of the ladder can pass to be removed from the ladder-restraining device.

[0058] Preferably the moving of the ladder-restraining device into the open condition is effected from below the ladder-restraining device. More preferably, opening of the ladder-restraining device is effected from the foot of the ladder which is to be located in the ladder-restraining

device. The user of the ladder therefore does not have to climb the ladder before it is restrained.

[0059] Preferably the ladder-restraining device is opened by using an elongate force-transmission means to apply a force to the second enclosing member.

[0060] The elongate force-transmission means may be configured as a rope, chain, cable, cord or rod arranged to be attached to the second enclosing member. The rope or cord may be pulled to move the second enclosing means and open the ladder-restraining device to the open condition. Alternatively, the elongate member may be a pole or stick, or the ladder itself, which can be used to push or pull the second enclosing means to open the ladder-restraining device to the open condition.

[0061] Preferably, the method comprises the step of closing the ladder-restraining device by gravity. The centre of gravity of the second enclosing member may be such that the ladder-restraining device is biased to the closed condition. Thus when no force is applied to the second enclosing member it will move to the closed condition.

[0062] The first and second enclosing members may be pivotally connected. Moving the second enclosing member between the open condition and the closed condition may be effected by pivoting the second enclosing member about the pivotal connection. The application of a force to the second enclosing member may result in the second member pivoting about the pivotal connection into the open condition.

[0063] Alternatively, the first and second enclosing members may be slidably connected. Moving the second enclosing member between the open condition and the closed condition may be effected by sliding the second enclosing member relative to the first enclosing member. The application of a force to the second enclosing member may result in the second member sliding into the open condition.

[0064] The method may comprise the step of first removing the means to secure the enclosing members closed. This may require the removal of a padlock located in aligned holes in the first and second enclosing members in the closed condition in order to allow the ladder-restraining device to be moved to the open condition.

[0065] As most ladders have a roughly similar rung diameter or size and length the ladder-restraining device is preferably configured to accommodate many different ladders.

[0066] Preferably the ladder-restraining device is configured to prevent, in use, any significant movement of a ladder in any direction. More specifically, the ladder-restraining device restrains the ladder reducing lateral movement or twisting/rotation of the ladder and preventing the ladder from falling away from the surface against which it is positioned. Preferably when retained in the ladder-restraining device there is no more than about 40mm between the enclosing member and the side

arms of the ladder, and no more than about 20mm between the surface of the ladder rung and the enclosure defined by the first and second enclosing members of the ladder-restraining device in the closed condition, when the rung is located in the centre of the enclosure.

[0067] Preferably the ladder-restraining device includes means for reducing lateral movement of a ladder rung restrained in a position of use. The means may be arranged to clamp the rung in a position of use. To remove a ladder from the ladder-restraining device the means for reducing lateral movement may first have to be released. Preferably the means for reducing lateral movement is released before the ladder-restraining device is moved to the open condition.

[0068] The ladder-restraining device may be mounted on any suitable rigid support surface, for example on a scaffolding pole, on a telegraph pole, on a lamp post or on a building. It will be appreciated that this list is far from exhaustive, and the skilled man will appreciate that there are many more surfaces to which the ladder-restraining device could be mounted.

[0069] Embodiments of the invention will now be described in more detail, by way of example only, with reference to the accompanying drawings.

Figure 1A is a schematic perspective view from the side of the ladder-restraining device in the closed condition;

Figure 1B is a schematic perspective view from above of the ladder-restraining device of Figure 1A in the closed condition;

Figure 2A is a schematic perspective view from the side of the ladder-restraining device of Figures 1A and 1B in the open condition;

Figure 2B is a schematic perspective view from the side and below of the ladder-restraining device of Figures 1A to 2A in the open condition;

Figure 3 is a schematic perspective view of the ladder-restraining device of Figures 1A to 2B attached to a scaffold pole in the open condition;

Figure 4 is a schematic perspective view of the ladder-restraining device attached to a scaffold pole in the open condition as in Figure 3 with a ladder rung positioned in the open ladder-restraining device;

Figure 5 is a schematic perspective view of the ladder-restraining device of Figure 4 with the ladder-restraining device in the closed condition;

Figure 6A is a schematic rear perspective view of the ladder-restraining of Figure 5;

Figure 6B is a schematic perspective side view de-

tailoring the clamp device for attaching the ladder-restraining device to a scaffold pole;

Figure 7 is a schematic plan view of a ladder-restraining device with an alternative mounting means to that depicted in Figure 6;

Figure 8 is a schematic plan view of a ladder-restraining device with an alternative mounting means to that depicted in Figures 6 and 7.

Figure 9 is a schematic perspective view of the ladder-restraining device of Figures 3 attached to a scaffold pole in the open condition, the device includes two points for applying a force to open and close the device;

Figure 10 is a schematic perspective view of a ladder-restraining device and a light mounted on the same backing plate;

Figures 11A and 11B are schematic perspective views of alternative ladder-restraining device and rail configurations.

Figure 12 is a schematic perspective view from the front of an alternative ladder-restraining device to that depicted in Figures 1 to 11B in the open condition;

Figure 13 is a schematic perspective view from below of one end of the ladder-restraining device of Figure 12 in the closed condition;

Figure 14 is a schematic end view of the ladder-restraining device of Figures 12 and 13 in the closed condition, the view is the opposite end to that of Figure 13;

Figures 15A to 15C are cross sectional views taken along line A-A' in Figure 13 showing a ladder-restraining device according to Figures 12 to 14 in an open condition, in a closed condition restraining a ladder rung, and in closed condition clamping a ladder rung;

Figure 15A shows a cross sectional view of the ladder-restraining device of Figure 13 in the open configuration;

Figure 15B shows a cross sectional view of the ladder-restraining device of Figure 15A with a ladder rung restrained in the device; and

Figure 15C shows a cross sectional view of the ladder-restraining device of Figure 15B with the ladder rung clamped in the device;

[0070] Referring to Figures 1A to 5 a ladder-restraining device 10 for restraining a ladder to a structure comprises a mounting means 12 (not illustrated in Figures 1A to 2B) for mounting the ladder-restraining device 10 to a structure, such as a scaffold pole 14, and a first enclosing member or lower jaw 15 and a second enclosing member or upper jaw 16.

[0071] More specifically, referring to Figures 1A to 2B the lower jaw 15 comprises a back plate 34 and two substantially planar, parallel side arms 31, 32 perpendicular to the back plate 34. Each of the side arms has an upwardly facing projection 24, 25 which defines a recess 41, 42 in the side arm 31, 32.

[0072] The upper jaw 16 comprises a connecting back bar 39 and two substantially planar and parallel, S-shaped side arms 35, 37. At the forward end, the side arms 35, 37 have a downward facing projection 27, 28 which defines a recess 45, 47 in the side arm 35, 37. At the rearward end the side arms 35, 37 have a rearward facing projection 51, 52 which abuts, in use, with the back plate 34 of the lower jaw 15 to restrict the extent of the pivotal movement of the upper jaw 16.

[0073] The connecting back bar 39 includes an attachment point 49 for attaching a rope 50 to the upper jaw 16.

[0074] The upper jaw 16 also includes a textured step 44 between the side arms 35, 37 which in use overlies the rung 22 of a ladder 23 to form a step, which is used instead of the rung 22. The texture 46 on the step 44 serves to make the step 44 anti-slip.

[0075] The lower jaw 15 and upper jaw 16 are pivotally connected by a nut and bolt assembly 19 which passes through the side arms 31, 32 of the lower jaw 15 and the side arms 35, 37 of the upper jaw 16. The upper jaw 15 side arms 35, 37 are nested inside in the lower jaw 16 side arms 31, 32.

[0076] In the closed condition depicted in Figures 1A, 1B and 5 the upper jaw 16 is prevented from pivoting further by the interaction of the rearward projections 51, 52 of the side arms 35, 37 with the back plate 34 of the lower jaw 15. The upper surfaces 53, 54 of the rearward projections 51, 52 abut with the back plate 34 to prevent any further rotation of the upper jaw 16 about the pivotal axis defined by the bolt of the nut and bolt assembly 19. The weight of the upper jaw 16 biases the ladder-restraining device 10 into the closed position, that is, in the absence of the application of force to the upper jaw 16 the ladder-restraining device 10 will adopt the closed condition (Figure 1A and 1B).

[0077] To move the ladder-restraining device 10 from the closed condition of Figures 1A, 1B and 5 to the open condition of Figures 2, 2B, 3 and 4 a force must be applied to the upper jaw 16. This is applied by pulling on the rope 50 attached by clip 49 to the connecting back bar 39. This force causes the upper jaw 16 to pivot anticlockwise about the axis defined by the bolt of the nut and bolt assembly 19 which connects the upper jaw 16 and the lower jaw 15.

[0078] The extent of movement of the upper jaw 16 is restricted by the abutment of the side arms 35, 37 of the upper jaw 16 with the back plate 34 of the lower jaw 15.

[0079] Once the ladder-restraining device 10 is in the open condition the upper jaw 16 and the lower jaw 15 define an opening 56 through which the rung 22 of a ladder 23 can be passed (Figure 4) into the ladder-restraining device 10.

[0080] To close the ladder-restraining device 10 around the rung 22 of the ladder, the pulling force on the rope 50 attached to the upper jaw 16 is released and upper jaw 16 pivots to adopt the closed condition (Figure 5). In this closed condition the opening 56 defined by the upper jaw 16 and the lower jaw 15 is eliminated, and the rung 22 is completely enclosed.

[0081] In this embodiment the ladder-restraining device 10 is biased to the closed condition, that is the centre of gravity of the upper jaw 16 is such that the resting position of the upper jaw 16 is in the closed position, and when no force is applied the upper jaw 16 will fall to the closed condition. In an alternative embodiment depicted in Figure 9 the centre of gravity does not bias the ladder-restraining device 10 in any particular condition. Rather a rope 50 attached to the connecting back bar 39 is pulled to move the upper jaw 16 into the open condition, and a rope 150 attached to the step 44 is pulled to move the upper jaw 16 into the closed condition.

[0082] When the ladder-restraining device 10 is in the closed condition (Figure 5), the rung 22 of the ladder 23 is located in an enclosure created by the recesses 41, 42 in the lower jaw 15 and the recesses 45, 47 in the upper jaw 16.

[0083] The side arms 31, 32 of the lower jaw 15 and the side arms 35, 37 of the upper jaw 16 completely enclose a part of the rung 22 of the ladder 23 close to the side member 33, 36 of the ladder 23. The gap between the outer face of the side arms 31, 32 of the lower jaw 15 and the side members 33, 36 of the ladder 23 is typically some 30 to 40mm.

[0084] In completely enclosing the rung 22, the upwardly facing projections 24, 25 of the side arms 31, 32 of the lower jaw 15 overlap somewhat with the downward facing projections 27, 28 of the side arms 35, 37 of the upper jaw 16. The jaws 15 and 16 may grip the ladder rung 22, but normally they will clamp it as such but rather encircle it.

[0085] In order to allow the ladder-restraining device 10 to be secured in the closed condition, the ladder-restraining device is configured with a hole 7 in the projection 24 of the side arm 31 of the lower jaw 15 and a hole 8 in the projection 28 of the side arm 37 of the upper jaw 16. When the ladder-restraining device 10 is in the closed condition the holes 7, 8 are aligned and a padlock 9 can then be located in the aligned holes 7, 8 to prevent any pivotal movement of the upper jaw 16. Thus the ladder-restraining device 10 cannot be opened and the ladder rung cannot be removed without first removing the padlock 9.

[0086] Referring to Figures 3, 4, 5 and 6 the ladder-restraining device 10 is depicted attached to scaffold pole 14.

[0087] More specifically, Figure 6 and 6B depict in more detail the clamp 12 used to mount the ladder-restraining device 10 onto a scaffold pole 14. The clamp 12 comprises two arms 71, 72, one arm 72 is attached to the back plate 34 of the lower jaw 15, and the other arm 71 is pivotally connected to the first arm 71 by a pin 72. Both arms 71, 72 are contoured to clamp onto a scaffold pole 14. In order to mount the ladder-restraining device 10 onto the scaffold pole 14 arms 71 and 72 of the clamp 12 are positioned around the pole 14 and then secured together at the opposite end to the pivot pin 72 by a further pin 74 and bolt 75 arrangement.

[0088] The clamp 12 configuration allows the ladder-restraining device 10 to be mounted on the scaffold pole 14 before or during erection of the scaffolding. Thus once the scaffolding 14 is in place, with one or more ladder-restraining devices 10 appropriately positioned, a ladder 23 can be easily secured to the scaffolding 14, and restrained from any substantial movement, from the ground or a scaffold plank before the user climbs the ladder 23. This allows a roofer, a bricklayer, a plasterer etc to work more safely on the scaffolding.

[0089] Figure 7 depicts a ladder-restraining device 110 with an alternative mounting means or clamp 112 to that depicted in Figures 3 and 6. The alternative clamp 112 comprises two members 111, 114 each comprising a curved portion 117 and two straight portions 118, 119. The members 111, 114 are arranged such that the curved portions 117 of the clamp 112 can be located around a substantially circular structure. The straight portions 118, 119 of one member 114 are connected to the straight portions of the other member 111 by a nut 121 and bolt 120 assembly.

[0090] In use the clamp 112 is located around a substantially circular object, such as a telegraph pole or lamppost, and the nut 121 and bolt 120 are tightened to prevent movement of the ladder-restraining device 110. Once the ladder-restraining device 100 is clamped in position, the device can be operated as described above and a rung 22 of a ladder 23 can be located between the lower jaw 115 and the upper jaw 116 of the ladder-restraining device 110 and the ladder 23 is restrained from any substantial movement.

[0091] Figure 8 depicts a ladder-restraining device 210 with an alternative mounting means 212 to that depicted in Figures 3, 6 and 7, in this example the ladder-restraining device 210 is screwed to a surface rather than clamped to a surface.

[0092] The mounting means 212 comprises a back mounting plate 226 with two parallel planar arms 229, 230 extending at right angles from the back mounting plate 226. The arms 229, 230 are inset somewhat from the end of the back mounting plate 214, and are spaced apart from each other. Holes 211, 213 allow the mounting means 212 to be screwed to a surface.

[0093] The side arms 231, 232 of the lower jaw 215 extend in a rearward direction, towards the back mounting plate 226 to form arm extensions 217, 219.

[0094] Arm extensions 217, 219 are nested inside arms 229, 230 and connected thereto by a nut and bolt assembly 230. Both the arm extensions 217, 219 and the arms 229, 230 have a further two sets of holes 237, 238 through which the nut and bolt 23 assembly can be placed. The different holes allow the distance of the upper jaw 216 and lower jaw 215 from a surface to be adjusted. For example, if the ladder is to be located in order to maintain guttering, which typically protrudes somewhat from the wall, it will be desirable to have the ladder fixed further from the wall, than if the ladder is to be located to clean a window.

[0095] The skilled man will appreciate that alternative mounting means could be devised for use with alternative surfaces or in particular circumstances. For example, by modifying the arrangement depicted in Figure 8 such that the back mounting plate 226 is L-shaped the ladder-restraining device could easily be mounted onto the corner of a building.

[0096] It is envisaged that the ladder-restraining device of the present invention could be retrofitted to existing surfaces, for example to a building, telegraph pole, scaffold pole etc. The ladder-restraining device could also be incorporated into new surfaces, for example, in connection with any article on a building which will need servicing, such as, air conditioning units, guttering, security lights and surveillance cameras. The ladder-restraining device could also be used restrain ladders used in lift shafts, sewers or manholes.

[0097] Referring to Figure 10 a ladder-restraining device 240 and a light 250 are depicted mounted on a backing plate 242, ready for mounting on a surface using mounting holes 243, 244, 245, 246. Brackets 247, 248 attached to the ladder-restraining device 240 are used to mount the ladder-restraining device 240 onto the back plate 242. In this arrangement a light 250, such as a security light, can be mounted onto a surface with a ladder-restraining device 240 already mounted on the same backing plate 242, this makes future maintenance of the light easier and safer.

[0098] Referring to Figures 11A and 11B a ladder-restraining device 255 is depicted mounted on a rail 260, 270, the ladder-restraining device 255 can move along the rail 260, 270 and be locked into a position of the user's choosing.

[0099] More specifically, in Figure 11A the ladder-restraining device 255 is mounted on a back plate 257, which is in turn mounted on rails 258, 259. Rails 258, 259 include wall attachment arms 261, 262, perpendicular to the rails 258, 259 which allow the rails to be attached to a surface, such as a wall. The ladder-restraining device 255 can be moved along the rails 258, 259 and be releasably fixed at any point along the rails 258, 259.

[0100] Figure 11B depicts an alternative rail 270 to

that depicted in Figure 11A. In this embodiment the ladder-restraining device 255 is again mounted on a back plate 271. The back plate 271 is coupled by a coupling 273 to a carriage 274 located within a rail 270. The rail 270 is configured as a U-shaped channel along which the carriage 274 can move to locate the ladder-restraining device 255 at a position where it is needed. Brackets 276, 277 can be used to mount the rail on a surface, such as a wall.

[0101] Referring to Figures 12 to 15C a ladder-restraining device 310 for restraining a ladder to a structure comprises a mounting means 312 for mounting the ladder-restraining device 10 to a structure, preferably a rigid support structure capable of supporting a ladder with a person on the ladder, such as a scaffold pole (not shown), and a first enclosing member or lower jaw 315 and a second enclosing member or upper jaw 316.

[0102] More specifically, the lower jaw 315 comprises a back plate 334 and two substantially planar, parallel side arms 331, 332 perpendicular to the back plate 34. Each of the side arms has an upwardly facing projection 324, 325 which defines a recess 341, 342 in the side arm 331, 332.

[0103] The upper jaw 316 comprises a connecting bar 339 and two substantially planar and parallel, S-shaped side arms 335, 337. At the forward end, the side arms 335, 337 have a downward facing projection 327, 328 which defines a recess 345, 347 in the side arm 335, 337. At the rearward end the side arms 335, 337 have a rearward facing projection 351, 352 which engages, in use, with the back plate 334 of the lower jaw 315 and acts as a stop to restrict the extent of the pivotal movement of the upper jaw 316.

[0104] The rearward facing projection 351 includes an attachment point 349 for attaching a rope or other elongate force transmission element to the upper jaw 316, and a hole 377 for locating a padlock (or other lockable formation) to secure the device in the closed condition.

[0105] The upper jaw 16 also includes a textured (eg ribbed) step 344 between the side arms 335, 337 which in use overlies the rung of a ladder to form a step, which is used instead of the rung. The texture on the step serves to make the step anti-slip.

[0106] The lower jaw 315 and upper jaw 316 are pivotally connected by a nut and bolt pivot assembly 319 which passes through the side arms 331, 332 of the lower jaw 315 and the side arms 335, 337 of the upper jaw 316.

[0107] The upper jaw 315 side arms 335, 337 are nested inside the lower jaw 316 side arms 331, 332.

[0108] Figure 13 depicts a device 310 in the closed condition with a ladder rung 370 (depicted in dotted lines) located in the device. The upper 316 and lower 315 jaw are in the closed condition. However, the rearward projections 352 of the side arms 337 have not yet contacted the back plate 334 of the lower jaw 315 leaving a gap 357. The presence in use of the ladder rung in the recesses 341, 342 and 345, 347 of the device 310

prevents the device 310 fully closing leaving a gap 357 between the rearward projection 352 and the back plate 334 due to the contact of the ladder rung 370 with the surfaces of the recesses 341, 342, 345, 347 which prevents any further closure of the device 310.

[0109] In the configuration in Figure 13 lateral movement of the ladder rung 370 in the device 310 is still possible: the arms of the upper and lower jaws 315, 316 are not actually clamping the ladder rung 370, the arm 337 of the upper jaw 316 is just resting on the ladder rung 370. To reduce lateral movement of a ladder rung 370 in the device a rung-clamping member or actuator in the form of a threaded locking bolt 350 is provided. The bolt 350 is located in a guide 351 with a complementary screw thread on the back plate 334 of the lower jaw 315, and can be rotated to contact the connecting bar 339 of the upper jaw 316. The connecting bar 339 whilst providing structural support to the device 310 also serves as a force transmission element to transmit force from the rung-clamping actuator 350 to the lower and upper jaws 315, 316 to clamp a ladder rung 370 in use. Continued rotation of the threaded locking bolt 350 pushes the upper jaw 316 in the direction of the arrow 360, the first jaw 315 being fixed in position, thereby drawing the lower and upper jaws 315, 316 closer together such that they clamp onto the ladder rung 370 located in the device 310 and reduce lateral movement of the ladder. As the ladder rung 370 is clamped by the upper and lower jaws 315, 316, the gap 357 between the rearward projection 352 of the side arm 331 of the upper jaw 315 and the back plate 334 of the lower jaw 315 is reduced.

[0110] Contact of the threaded locking bolt 350 with the connection bar 339 also serves to secure the device 310 in the closed condition. In order to open the device 310 the threaded locking bolt 350 must be unscrewed.

[0111] To move the ladder-restraining device 310 from the closed condition to the open condition a force must be applied to the upper jaw 316. This is applied by pulling on the rope 370 attached by clip 371 to the hole 349 in the rearward projection 351 of the side arm 332. This force causes the upper jaw 316 to pivot anticlockwise about the axis defined by the bolt of the nut and bolt assembly 319 which connects the upper jaw 316 and the lower jaw 315.

[0112] Figures 15A to 15C illustrate the mode of operation of the device 310 to restrain and the clamp a ladder rung 370. In Figure 15A the device 310 is shown in the open condition, with the threaded locking bolt 350 unscrewed so that it is still within the guide 351 on back plate 334 of the lower jaw 315, but does not impede movement of the upper jaw 316.

[0113] In Figure 15B a ladder rung 370 is located in the device 310, in recesses 341, 347 in the lower and upper jaws 315, 316. The ladder is now restrained in position by location of the rung 370 in the device 310. However, some lateral movement of the rung 370, and hence the ladder, is still possible as the device 310, and in particular the upper jaw 316, is only resting on the

ladder rung 370 and not actually gripping or clamping the rung 370 and holding it in position.

[0114] Figure 15C depicts a ladder rung 370 clamped in the device 310 to reduce lateral movement. In order to clamp the rung 370 the threaded locking bolt 350 is rotated in the guide 351 to engage the connecting bar 339 on the upper jaw 316 drawing the lower and upper jaws 315, 316 together and clamping the ladder rung 370 in the device 310. Once clamped in the ladder rung 370 lateral movement of the ladder is reduced. In the clamped position the gap 357 between the rearward projection 352 of the side arm 331 of the upper jaw 315 and the back plate 334 of the lower jaw 315 is reduced, or eliminated as illustrated.

[0115] In order to allow the ladder-restraining device 310 to be secured in the closed condition, the ladder-restraining device 310 is configured with a hole 377 in the rearward projection 352 of the side arm 332. When the ladder-restraining device 10 is in the closed condition, as in Figure 14, the hole 377 is in position such that a padlock can be located in the holes 377 to prevent any substantial clockwise pivotal movement of the upper jaw 316. When a padlock is located in the hole 377 and the device 310 is in the closed condition, the device cannot be moved to the open condition without first removing the padlock.

[0116] In an alternative embodiment the ladder restraining device 310 can be secured in the closed condition by locking the threaded locking bolt 350 in a position where the lower and upper jaws 315, 316 are closed and drawn together as in Figure 15C so as to prevent unscrewing of the threaded locking bolt 350, and hence opening of the ladder-restraining device 310, without a key or specialised tool.

Claims

1. A ladder-restraining device (10) for restraining a ladder (23) to a structure, comprising a mounting means (12) for mounting the ladder-restraining device to the structure, a first enclosing member (15) and a second enclosing member (16), said second enclosing member being movable relative to the first enclosing member, and means (50) to allow a user to move the second enclosing member relative to the first enclosing member from a position remote from the device, the ladder restraining device having an open condition wherein the first and second enclosing members define an opening adapted to allow a rung (22) of a ladder (26) to enter said opening, and a closed condition wherein said opening is reduced or eliminated and wherein said first and second enclosing members together form an enclosure (41, 42) which is adapted, in use, to at least partially enclose a rung of a ladder and retain the rung in the enclosure.

2. A device according to Claim 1 wherein the rung is fully enclosed by the first and second enclosing members.
3. A device according to Claim 1 or Claim 2 wherein the application of force is required to move the device from the closed condition to the open condition. 5
4. A device according to any one of the preceding claims which is arranged to be biased to the closed position. 10
5. A device according to any preceding claim wherein the means to move the second enclosing member comprises an elongate force-transmission coupling arranged to be attached to the second enclosing member. 15
6. A device according to any one of the preceding claims wherein the first and second enclosing members are connected by a connecting means (19), such as a pivotal connection or a sliding means. 20
7. A device according to any one of the preceding claims wherein the second enclosing member comprises a plate member arranged to form a step (44) when the ladder-restraining device is in use and in the closed position. 25
8. A device according to any one of the preceding claims wherein the device, in use, at least partially encloses the ladder rung along only a part of the length of the rung. 30
9. A device according to any one of the preceding claims comprising means (9) to secure the enclosing members closed. 35
10. A device according to any one of the preceding claims which also comprises means (350) for reducing lateral movement of a ladder rung located in the device. 40
11. A device according to Claim 10 wherein the means for reducing lateral movement of the ladder rung is arranged to effect the movement of the second enclosing member towards the first enclosing member so that a ladder rung located in the device is clamped by the first and second enclosing members. 45
12. A device according to any one of Claims 10 to 11 wherein the means for reducing lateral movement of the ladder rung includes a threaded locking bolt attached to the first enclosing member, which is arranged to be moveable to contact the second enclosing member and draw the first and second enclosing members together. 50
13. A scaffold pole (14) with a ladder-restraining device (10) attached thereto, wherein the ladder-restraining device comprises a mounting means (12) for mounting the ladder-restraining device to the scaffold pole, a first enclosing member (15) and a second enclosing member (16), said second enclosing member being movable relative to the first enclosing member, and means (50) to allow a user to move the second enclosing member relative to the first enclosing member from a position remote from the device, the ladder restraining device having an open condition wherein the first and second enclosing members define an opening adapted to allow a rung (22) of a ladder (33) to enter said opening, and a closed condition wherein said opening is reduced or eliminated and wherein said first and second enclosing members together form an enclosure which is adapted, in use, to at least partially enclose a rung of a ladder and retain the rung in the enclosure.
14. A ladder-restraining assembly comprising a ladder-restraining device of any one of Claims 1 to 12 mounted on a carriage which is movable along a rail or guide.
15. An assembly according to Claim 14 wherein the carriage comprises a lock and release mechanism which allows the carriage to be releasably anchored at different positions along the rail or guide.
16. A method of restraining a ladder using a ladder-restraining device having a first enclosing member and a second enclosing member, said second enclosing member being movable relative to the first enclosing member to move the ladder-restraining device between an open condition and a closed condition, said device including means to move the second enclosing member relative to the first enclosing member from a position remote from the device, the method comprising the steps of passing a rung of a ladder through an opening defined by the first and second enclosing members when the ladder-restraining device is arranged in the open condition, moving the second enclosing member to bring the ladder-restraining device into the closed condition, reducing or eliminating the opening and at least partially enclosing the rung of the ladder with the first and second enclosing members, thereby retaining the ladder rung and restraining movement of the ladder.
17. A method of removing a ladder from a ladder-restraining device when a rung of the ladder is retained therein, said ladder-restraining device having a first enclosing member and a second enclosing member, said second enclosing member being movable relative to the first enclosing member to move the ladder-restraining device between an

open condition and a closed condition, the enclosing members defining an enclosure which at least partially encloses the rung of a ladder in the closed condition, the method comprising the steps of opening the ladder-restraining device by moving the second enclosing member, from a position remote to the device, relative to the first enclosing member into the open condition and removing the rung of the ladder from the ladder-restraining device.

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18. A method according to Claim 16 in which the rung of the ladder is fully enclosed by the first and second enclosing members.

19. A method according to Claim 17 wherein when the ladder-restraining device is moved into the open condition the first and second enclosing members define an opening through which the rung of the ladder can pass to be removed from the ladder-restraining device.

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20. A method according to any one of Claims 16 to 19 wherein the ladder-restraining device is opened by using an elongate force-transmission means to apply a force to the second enclosing member.

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21. A method according to any one of Claims 16 to 20 in which the first and second enclosing members are pivotally connected.

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22. A method according to Claim 21 in which the second enclosing member is moved between the open condition and the closed condition by pivoting the second enclosing member about the pivotal connection.

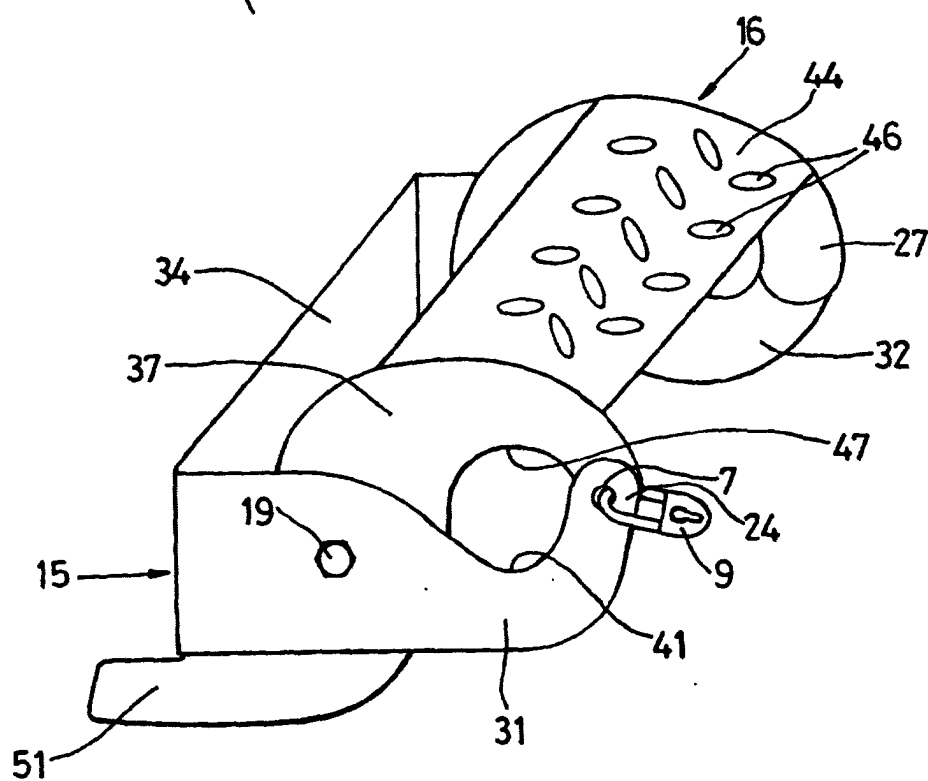
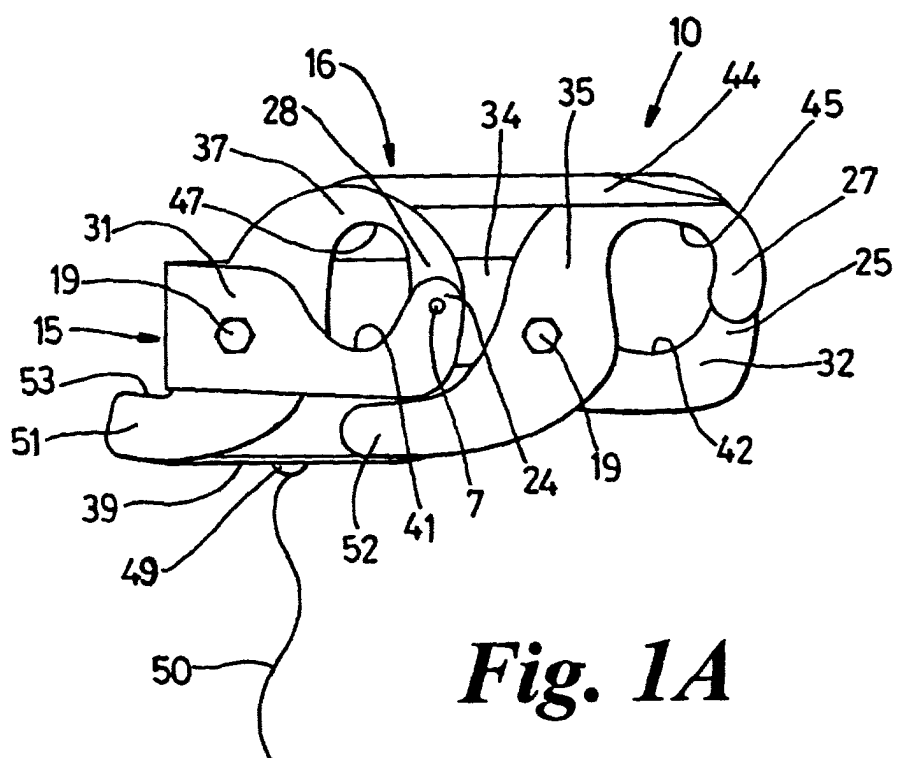
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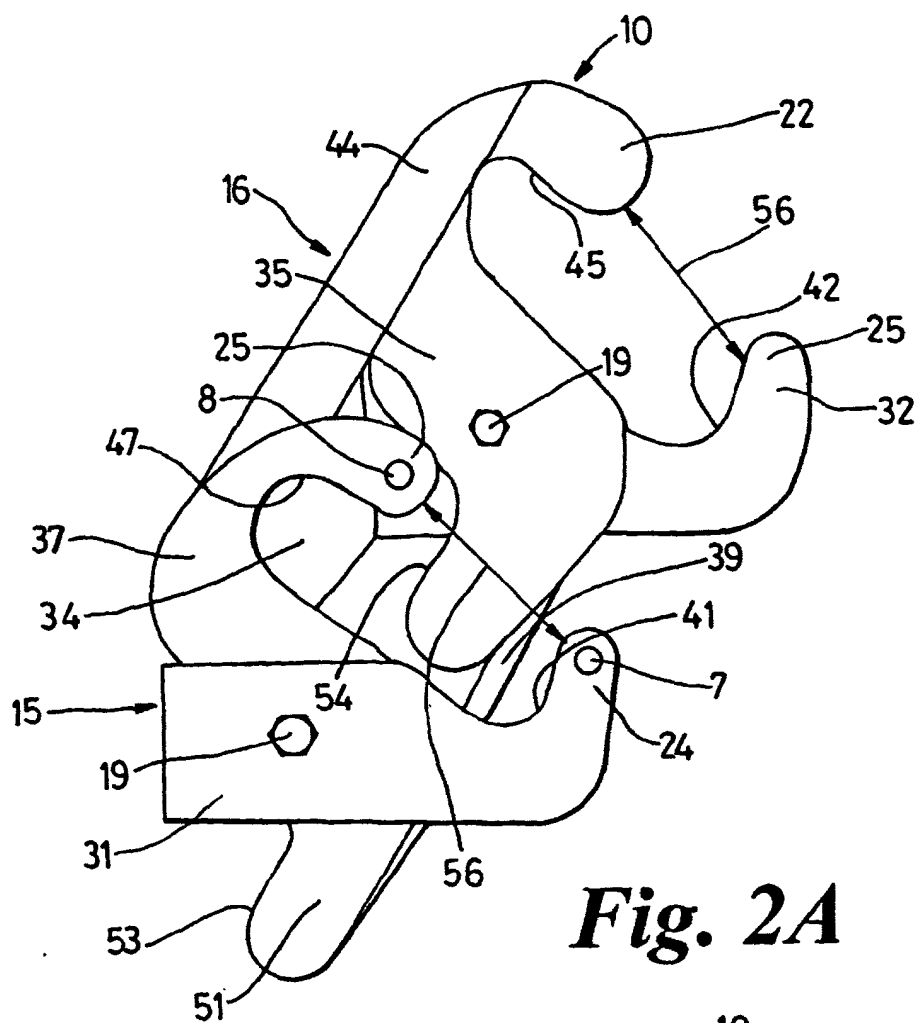


Fig. 2A

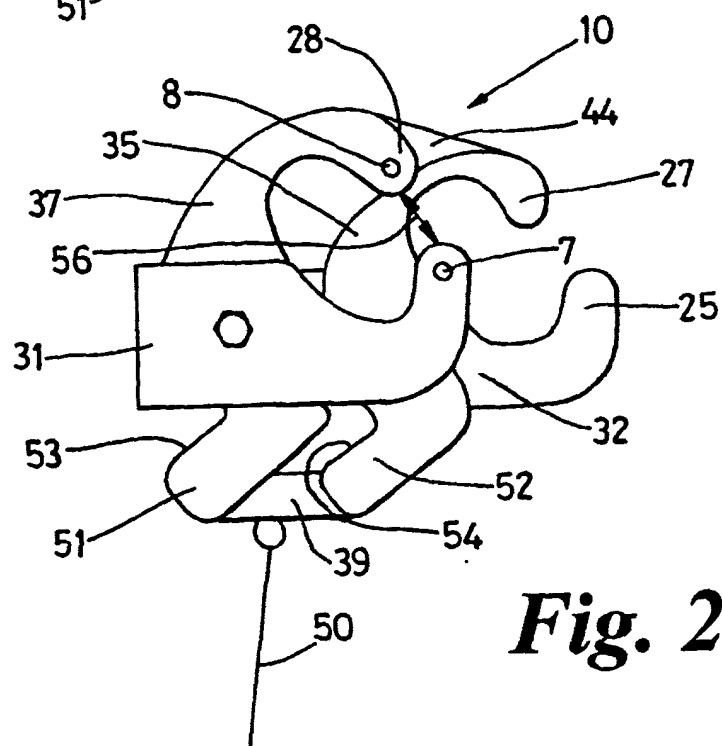
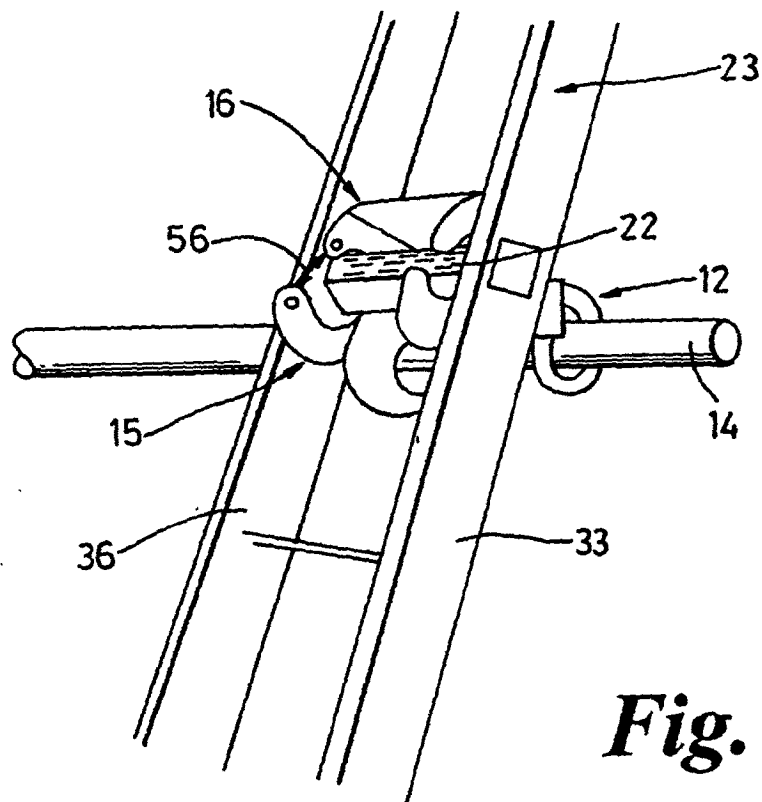
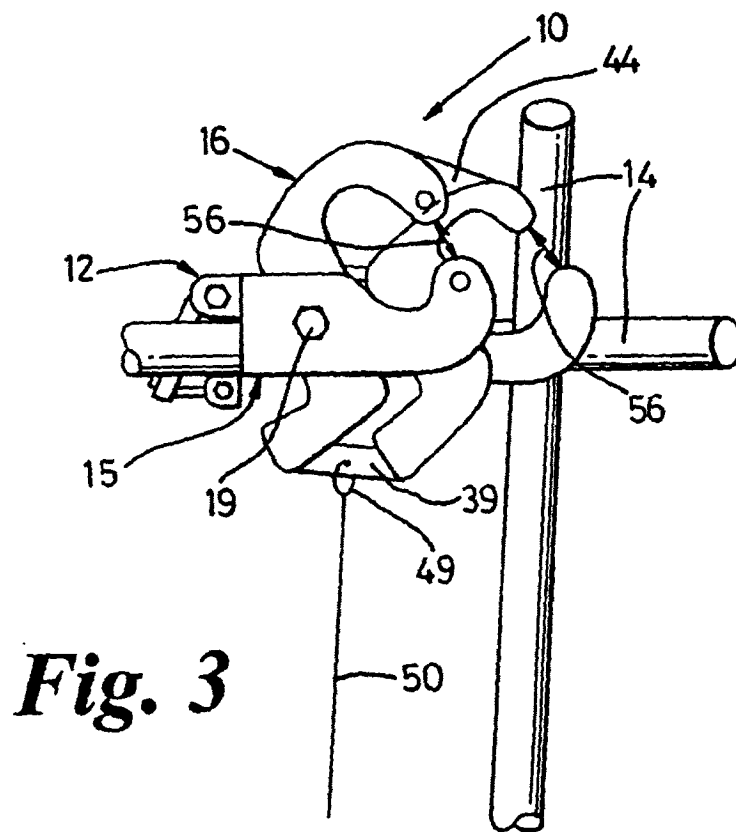


Fig. 2B



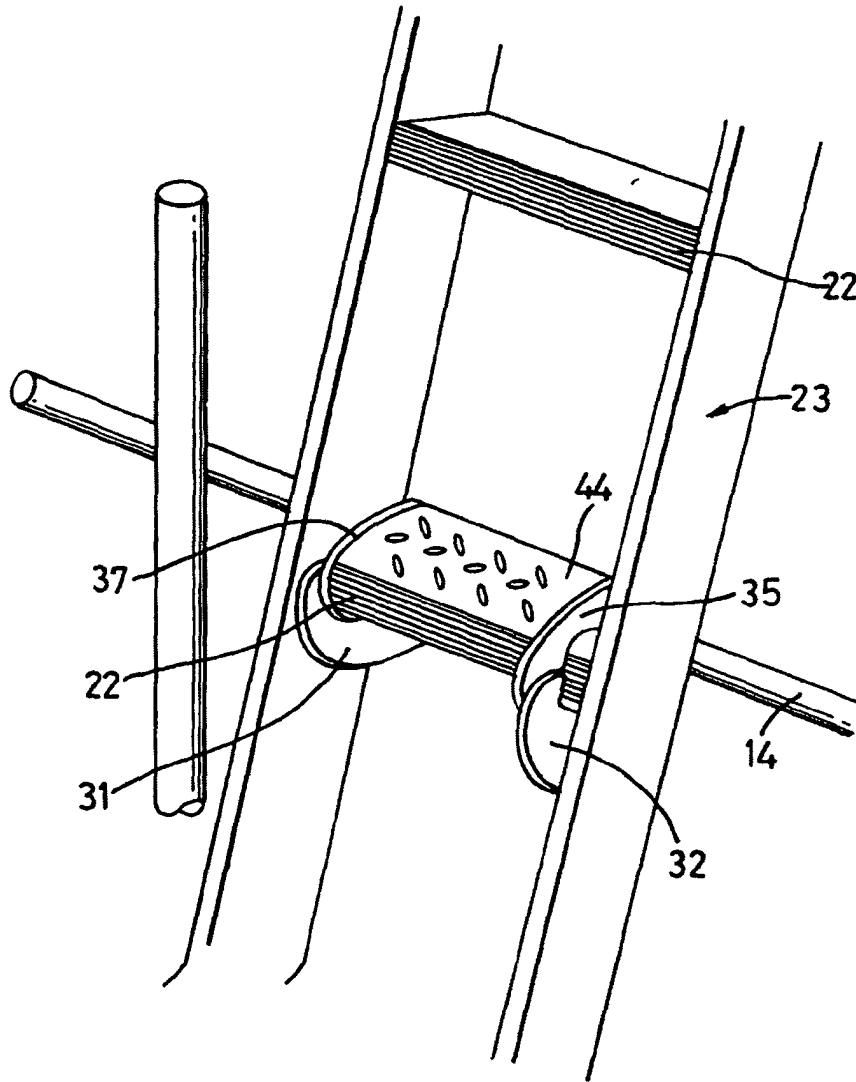


Fig. 5

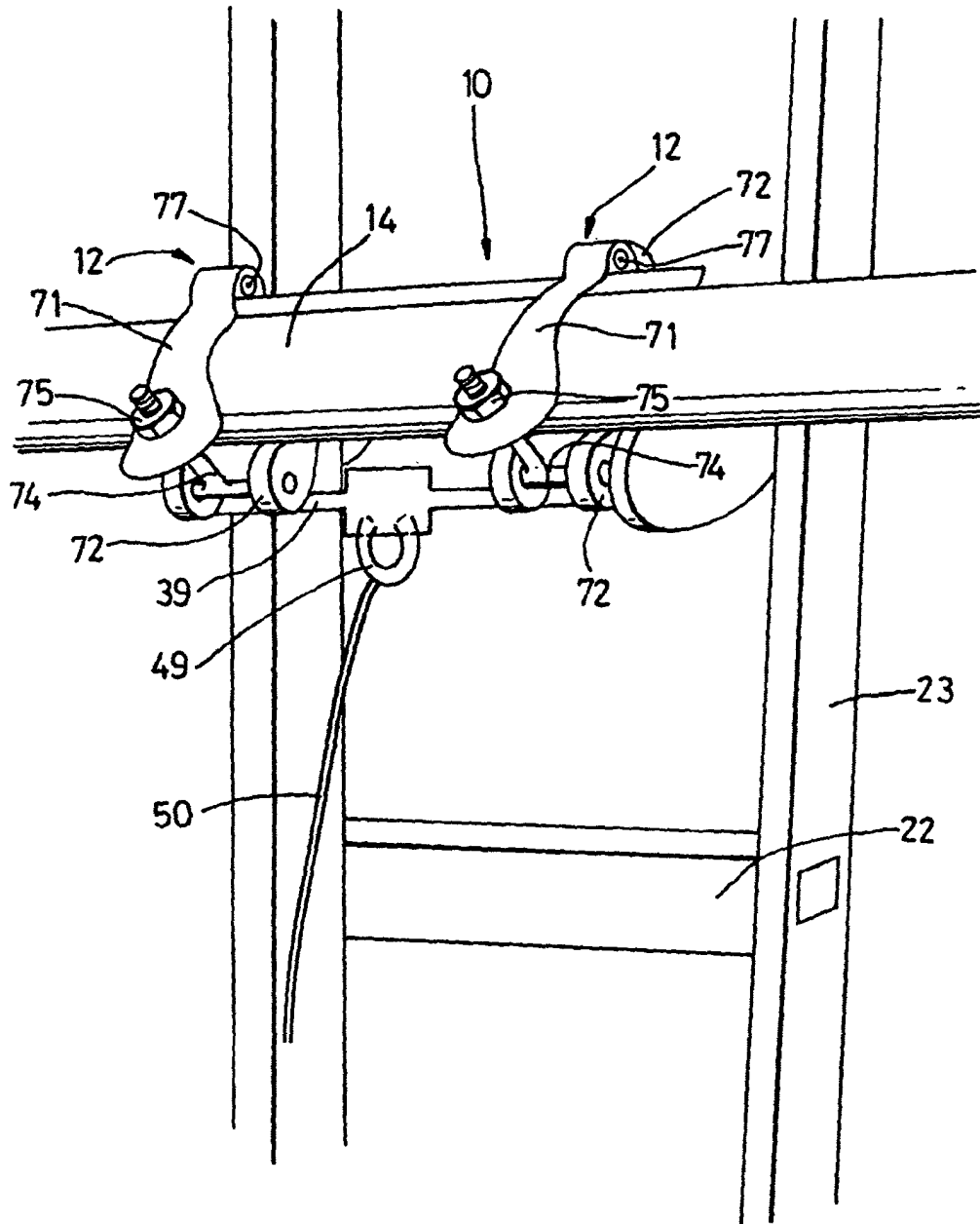
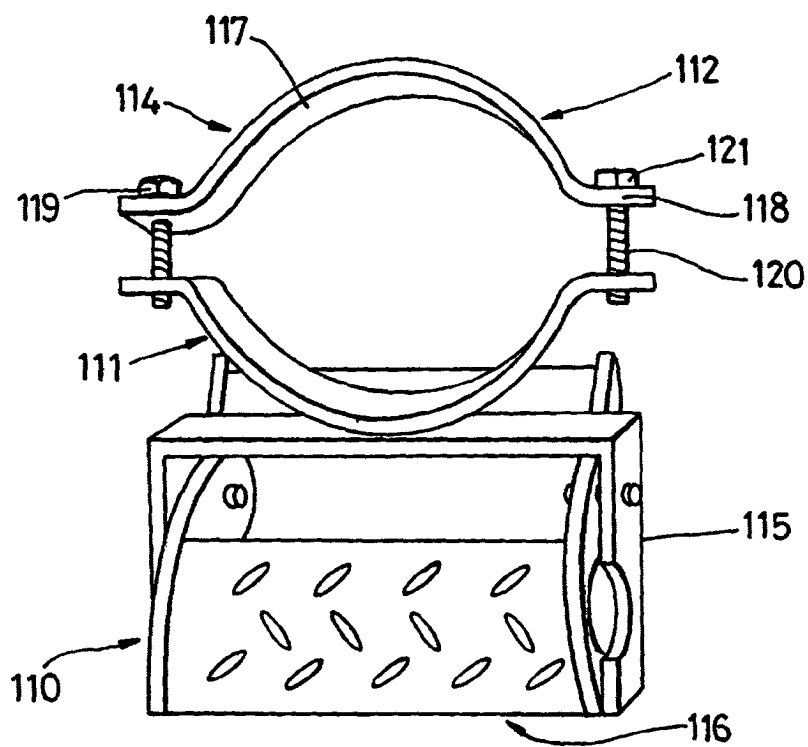
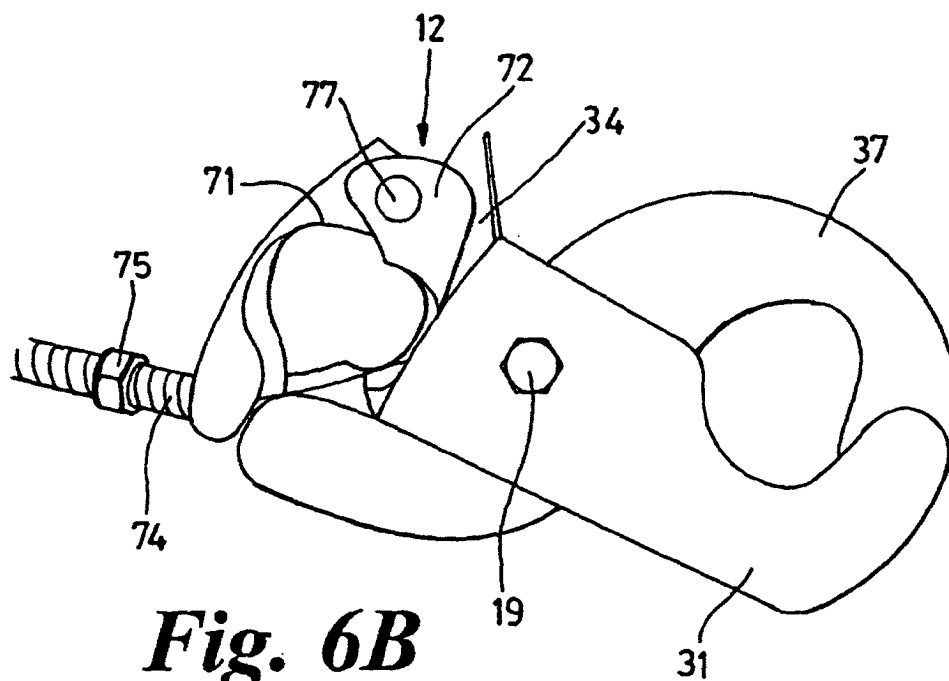
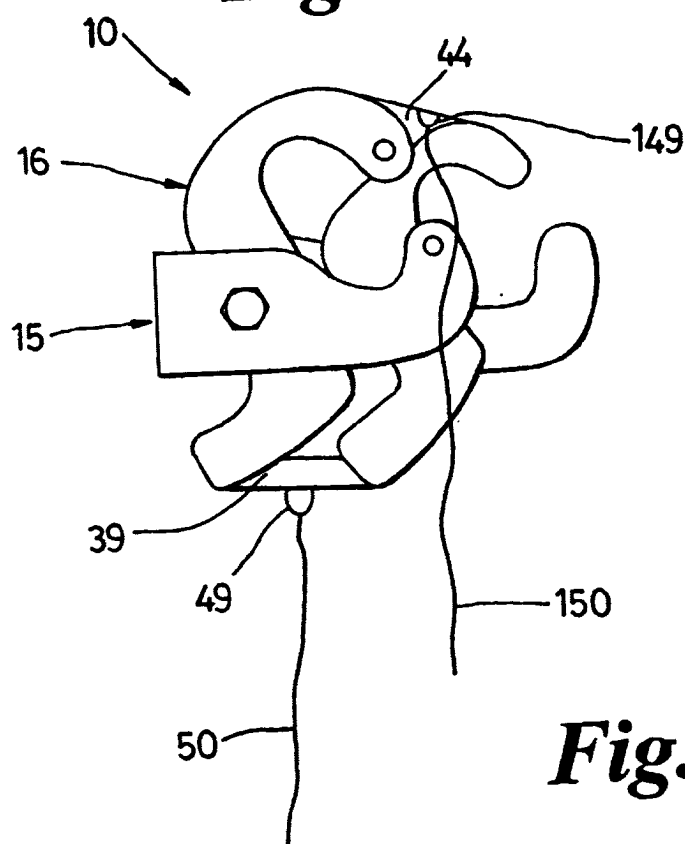
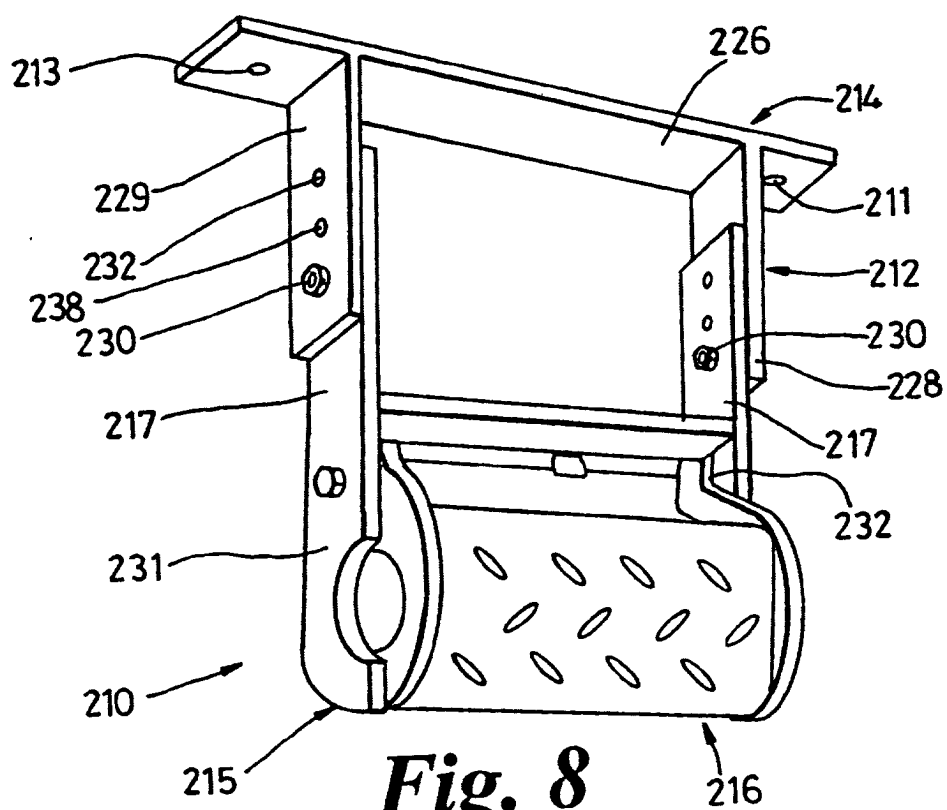


Fig. 6A





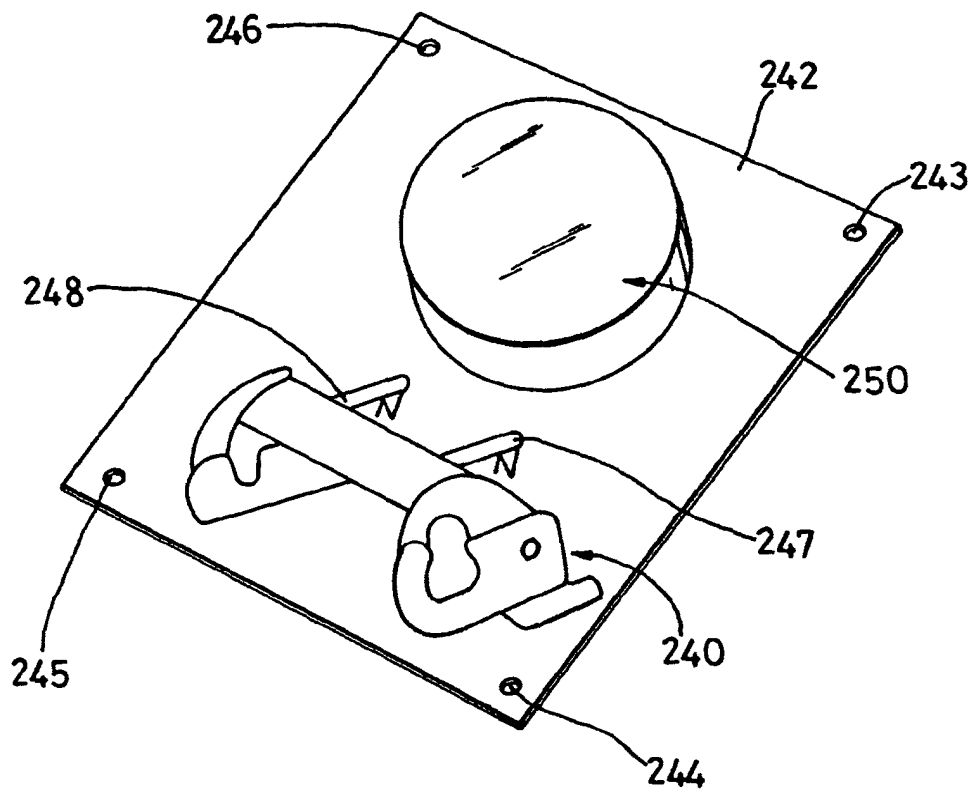


Fig. 10

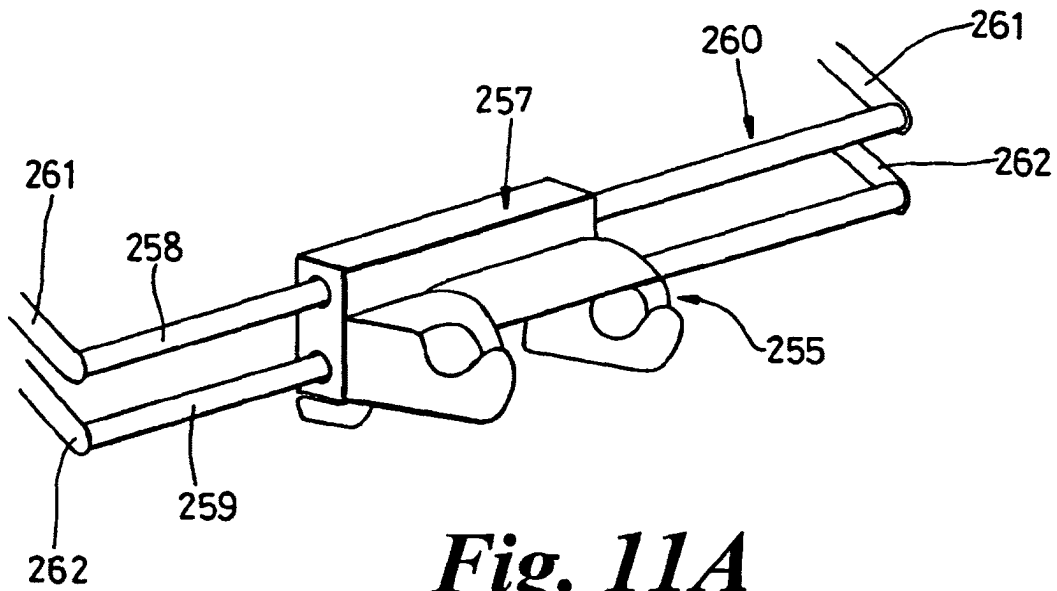


Fig. 11A

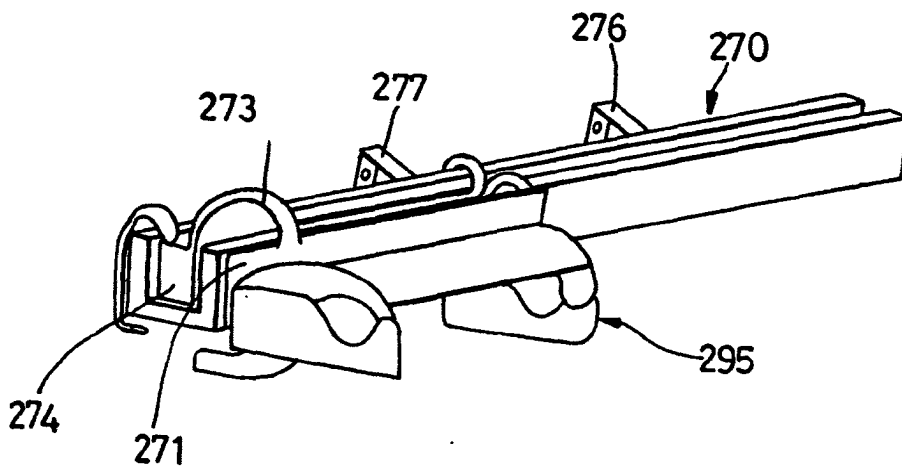


Fig. 11B

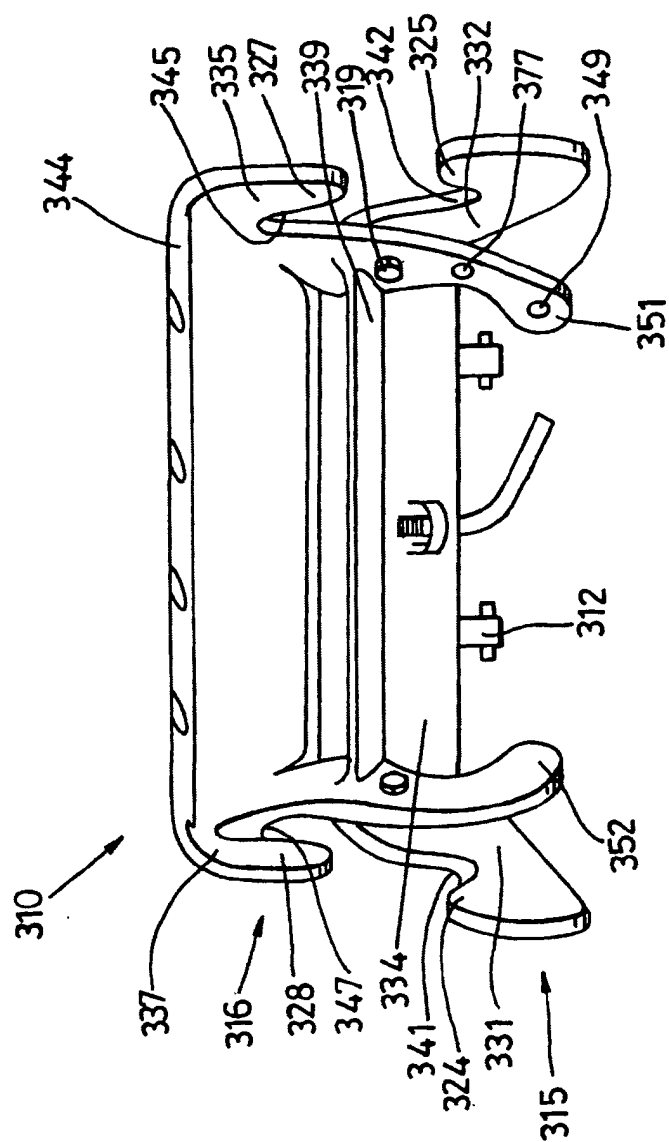


Fig. 12

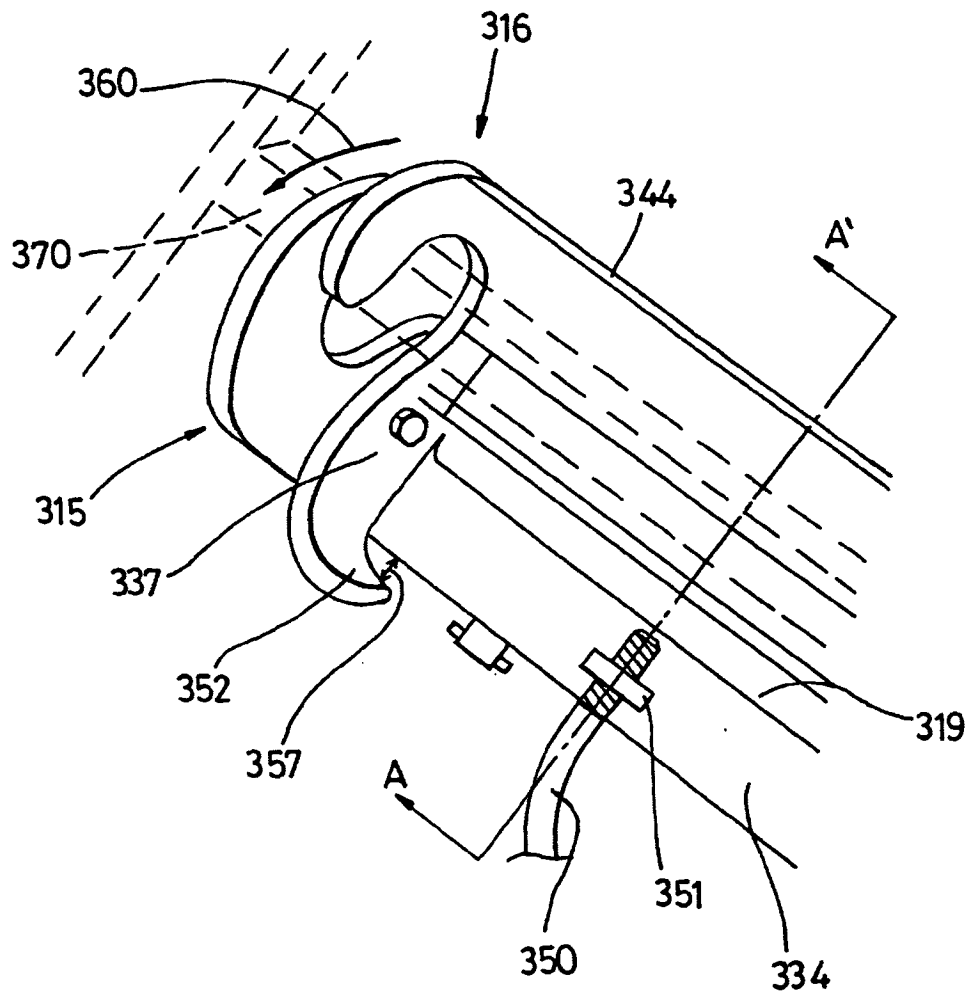
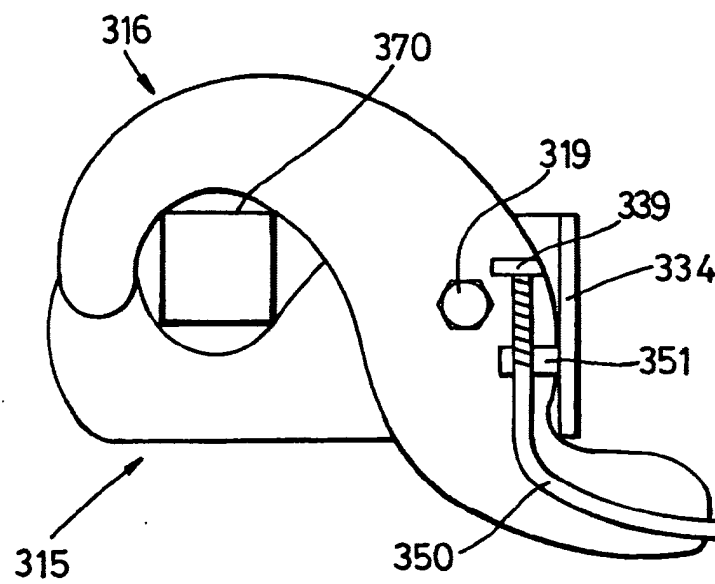
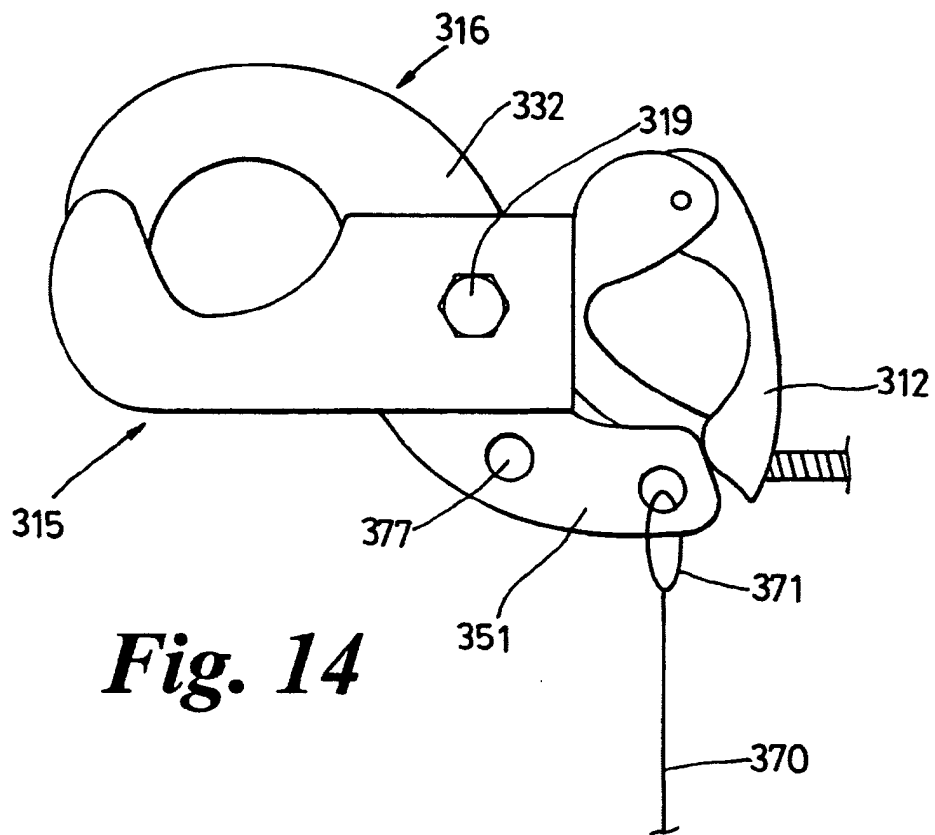


Fig. 13



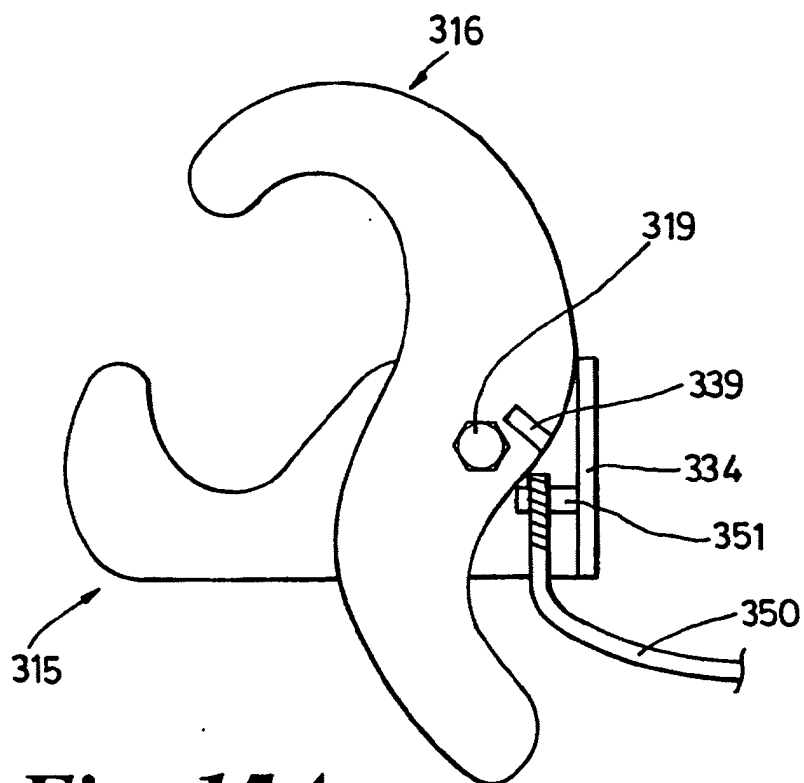


Fig. 15A

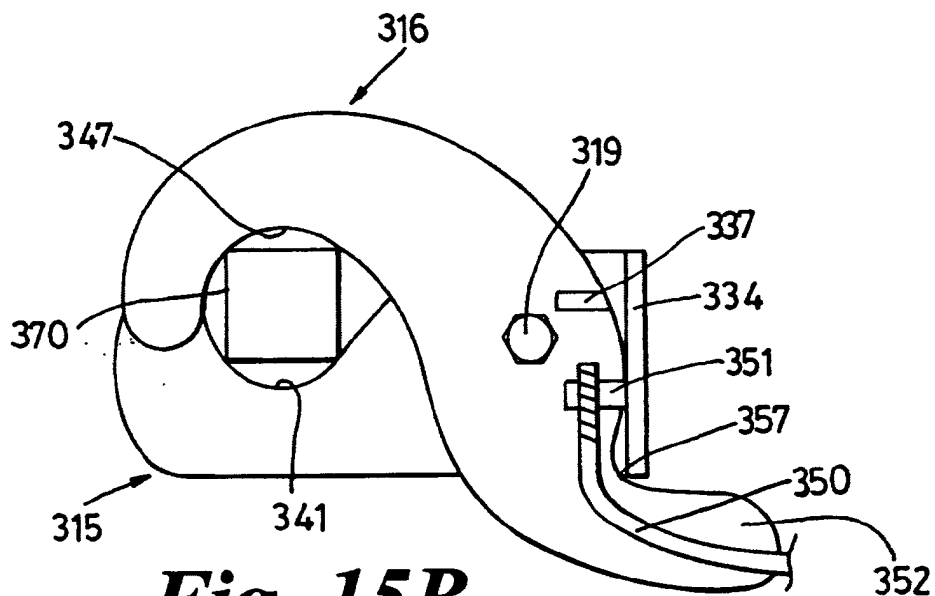


Fig. 15B



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 25 4426

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Place of search Munich		Date of completion of the search 9 November 2004	Examiner Saretta, G
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 04 25 4426

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