Dec. 1, 1942. A. I. ROKE 2,303,954

SAFETY DEVICE FOR WORKMEN ON STEEL STRUCTURES

Filed Feb. 18, 1942

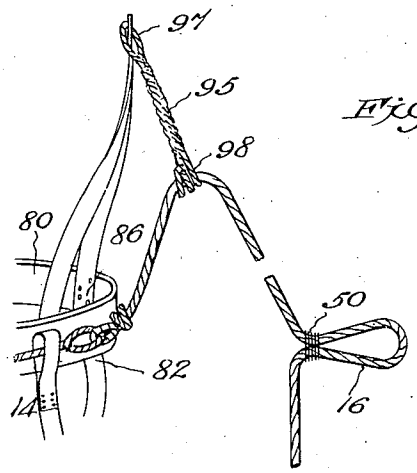


Fig. 1.

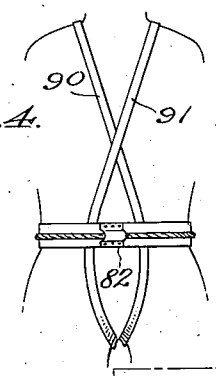


Fig. 4.

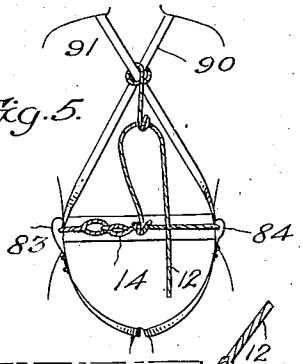


Fig. 5.

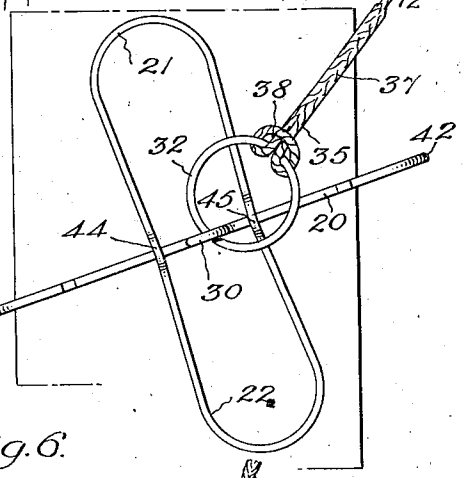


Fig. 2.

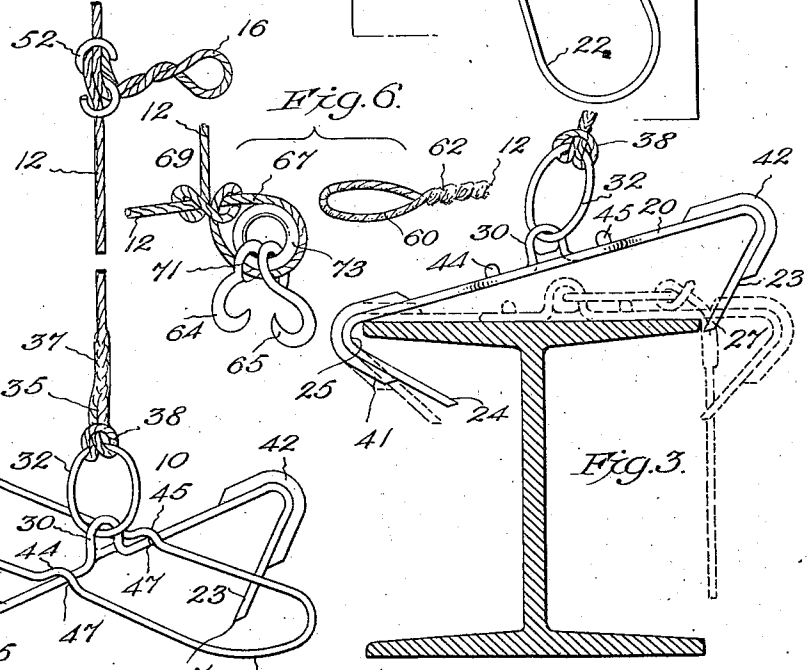


Fig. 6.

Fig. 3.

INVENTOR.
ALBERT I. ROKE
BY Gustav C. Thompson
ATTORNEY.

Patented Dec. 1, 1942

2,303,954

UNITED STATES PATENT OFFICE

2,303,954

SAFETY DEVICE FOR WORKMEN ON STEEL STRUCTURES

Albert I. Roke, Flushing, N. Y.

Application February 18, 1942, Serial No. 431,321

5 Claims. (Cl. 227—49)

This invention relates to safety devices for workmen on steel structures, and provides improvements therein.

There is a considerable hazard to workmen occupied in the erection of steel structures, such as steel frames for buildings, bridges, and the like, and the occupational insurance on this class of workmen is very high.

The present invention provides a device for reducing the hazards of this type of workman, and of reducing the burden on industry by reason of high occupational insurance.

The present invention provides a safety device which permits great freedom of movement of the workman, which is readily anchored to the steel structure, and, when the workman falls, checks without injurious suddenness the falling workman. The invention further provides means for righting the body of the falling workman before the fall is completely checked, and means to distribute the momentum of the falling body to a number of parts of the workman's body.

The invention further provides a device of the character described, which is of great simplicity, easily applied, readily understood in its mode of use and operation, safe and reliable in its operation, relatively light so as not to be an encumbrance to the movements of the workman, which makes use of simple and available materials, has long life, and which may be produced at a moderate cost.

An embodiment of the invention is illustrated in the accompanying drawing. The invention, however, may receive other embodiments than that herein specifically illustrated and described.

Referring to said drawing:

Fig. 1 is a perspective view illustrating said embodiment of the safety device.

Fig. 2 is a top plan view of the anchor, shown in relation to an I-beam.

Fig. 3 is a view in side elevation illustrating the application of the anchor to an I-beam.

Figs. 4 and 5 are views from the front and back respectively, illustrating one means for attaching the rope to the body of the workman.

Fig. 6 is a composite view illustrating one means for attaching the rope around the waist of the workman.

Referring to said figures, numeral 10 designates an anchor; numeral 12 designates a rope attached at one end to the anchor, and having at its other end a means 14 for attaching the rope to the body of the workman. Numeral 16 designates one or more shock absorbing means which act on the rope to check the momentum of the falling body of the workman.

The anchor 10 comprises a bar 20 constructed and arranged to span crosswise the flange of an I-beam, and having hooks 23, 24 at its ends constructed and arranged to engage the flange of the I-beam at opposite sides. Means are provided for stabilizing the bar 20 so that the hooks 23, 24 thereon remain perpendicular to the plane of the flange of the I-beam. The stabilizing means advantageously comprise wings 21, 22 attached to the bar 20, extending laterally thereof in the plane of the bar 20, and constructed and arranged to bear on the flange of the I-beam at each side of the bar 20, and maintain the bar in a position in which the hooks thereon remain perpendicular to the plane of the flange. The bar 20 and hooks 23, 24 are so constructed that the distance between the base 25 of a hook and the tip 27 of the opposite hook is approximately equal to the width across the flange, so that when the bar 20 is placed straight across the flange of the I-beam with the base 25 of one hook against the edge of the flange, the tip 27 of the opposite hook just about clears the opposite edge of the flange of the I-beam, as illustrated in Fig. 3. The hooks 23, 24 are relatively deep or long from the tip 27 to the base 25, so as to have a secure hold on the flange of the I-beam, and so that the tips 27 of both hooks 23 and 24, when the anchor is in a position running diagonally across the I-beam, are under the flange of the I-beam at both sides. The normal position of the anchor is diagonally of the I-beam as illustrated in Fig. 2.

The anchor is provided with means for attaching one end of the rope 12 thereto. One such means, as illustrated, comprises an eye 30 on the bar 20, and a ring 32 may be provided, which runs through the eye 30, and to which ring an end of the rope 12 is attached. For strength a loop 35 is formed at an end of the rope, as by splicing the end of the rope near one end, as indicated at 37, and then knotting or looping the loop 35 through the ring, as indicated at 38.

To lighten the anchor 10, consistent with adequate strength, and to enable the anchor to be dragged along an I-beam without noticeable resistance or impediment to the movements of the workman, the bar 20, hooks 23 and 24 thereon, and the wings 21, 22 may be formed of a bar of steel. Steel reinforcements 41, 42, may be

provided adjacent the ends of the bar 20 for strengthening the hooks 23, 24. The wings 21, 22 may be, as shown, a loop or ring of steel, with bands 44, 45, in each leg of the loop, about the middle thereof, which straddle the bar 20 and are attached to the bar by welding, as indicated at 47.

The rope 12 is advantageously the ordinary manila rope of commerce, of adequate strength, with a liberal factor of safety for stopping the momentum of the body of the workman should he fall, and the rope has an effective length to give the workman a normal or fair range of movement. The range of movement of the workman is provided by the length of the rope, and also by the capability of the anchor 10 sliding lengthwise of the I-beam. Ordinarily it is proposed to make the effective length of the rope about twelve to fourteen feet, as this would give the workman freedom to climb from one story to another, with the anchor in place on the I-beam of a floor below.

The cushioning means 16 is advantageously made in the form of one or more yieldable loops in the rope 12 itself. As shown in Fig. 1, a loop may be formed in the rope, and the portions of the loop adjacent the rope seized or bound by a cord 50, or by an S-hook 52, or other suitable means. The seizing means 50 is constructed and arranged so as to prevent the loop from yielding under the force of normal strains, but permit the loop to yield, and thereby cushion the action of the rope in stopping the momentum of the falling body, when a strong pull is exerted on the rope, as occurs when the rope is drawn taut by the momentum of a falling body which is attached thereto.

The means 14 for attaching the rope 12 to the body of the workman is advantageously primarily the rope itself, thereby having the attachment of the device to the body of the same strength as the rope itself. To this end a loop 60 may be formed in the rope, as by forming a loop in the end portion of the rope and splicing the end of the rope as indicated at 62, Fig. 6. At a distance from the loop 60 sufficient to enable the rope to snugly encircle the waist of the workman, means are provided for attachment of the rope to the loop 60. This means may comprise a pair of oppositely formed hooks 64, 65, which pass over the looped rope from opposite sides and in effect form a closed ring around the rope in the loop 60. The pair of hooks 64, 65 are advantageously attached to the rope 12 by means of a loop 67 in a non-slipping form of knot 69 formed in the rope, as for example a bow-line knot, illustrated in Fig. 6. The loop 67 passes through eyes 71 in the hook 64, 65, and a grooved eyelet 73 which passes through the eyes 71 in the hooks may be fastened within the loop 67 in the rope. The bowline knot 69 prevents the portion of the rope which is looped around the body of the user from slipping, and thereby avoids dangerous or fatal constriction of the body around the waist in the event of a fall by the user.

The means for attaching the rope to the body of the workman also advantageously comprises means for distributing the shock or reaction to the momentum of the falling body of the workman being stopped by the rope. This means advantageously comprises a broad belt 80 fastened around the body of the workman, and having eyes 82, 83, 84 for holding thereon the portion of the rope 12 which is fastened around the body of the workman. Attached to the belt, as indicated at 66, are a pair of crossed strips or belts 90, 91 which pass over the shoulders and under the crotch of the workman, as illustrated in Figs. 4 and 5. The straps 90, 91 serve to distribute a part of the reaction forces acting on the rope and belt to the shoulders and legs of the workman, and thereby take some of the strain from the midportion of the body and back.

Means are also advantageously provided for righting the body of the workman, should he fall head downward, before the momentum of the body is fully checked by the rope. To this end, as illustrated in Figs. 1 and 5, a link 95 may be provided between the crossed straps 90, 91, near the shoulders and a portion of the rope, a short distance from the portion which is fastened around the waist of the workman. The link 95 is conveniently in the form of a piece of cord looped around the shoulder straps 90, 91, adjacent the shoulder blade of the user, at the point where the straps cross, as indicated at 97, and also looped around the rope in the form of a clove hitch 98 as illustrated.

Operation

The workman steps into the straps 90, 91, and puts them over his shoulders crossing his body at the front and back. The portion of the rope 12 which passes around his waist is fastened by attaching the hooks 64, 65 to the loop 60 at the end of the rope 12. The link 95 holds a portion of the rope 12, adjacent the belt, extending upwardly, as illustrated in Fig. 1.

The workman then attaches the anchor 20, to which the opposite end of the rope 12 is fastened, to an I-beam. This he does by tilting the anchor, as illustrated in Fig. 3, and putting one of the hooks, as the hook 25, over the flange of the I-beam at one side, with an edge of the flange at the base 25 of the hook. The tip 27 of the opposite hook wil then just clear the edge of the flange at the opposite side of the I-beam. The anchor is then dropped to a position where it lies flat across the flange of the I-beam. The rope between the belt and the anchor falls at one side or the other of the I-beam and its weight is sufficient to slide the anchor, and maintain it, with the base 25 of the hook against the edge of the flange of the I-beam, at the side opposite that over which the rope falls. Ordinarily, after the anchor is put in place on the I-beam, it will take up a position diagonally across the I-beam, so that the tips of both hooks extend beneath the flange of the I-beam. After the anchor 20 has been put in place it may be purposely moved to a diagonal position, as illustrated in Fig. 2.

The rope has sufficient length to enable the workman to have a reasonable degree of freedom of movement. Moreover, his freedom of movement lengthwise of the beam is unrestricted, inasmuch as the anchor 20 will slide along the flange of the I-beam with slight resistance, as the workman moves along the I-beam. The wings 21, 22 prevent the bar 20 and the hooks 23, 24 thereon from tilting during these movements, as well as at other times. The effective length of the rope 12 may be adjusted to the requirements of the particular job, though ordinarily an effective length of about twelve feet is provided. Such a length enables the workman to climb vertical beams and make joints between the upright beams and columns and the cross-beams for the

next floor, and also to manipulate the rope to detach the anchor **10** from the lower I-beam and raise to the floor above and attach to the I-beam at that floor.

The rope **12** is provided with cushioning means **16**, as hereinbefore described.

In the event that the workman falls his descent will be stopped by the rope **12** which is attached to him and to the anchor **10**. The full force of the momentum of the fall of the workman is not immediately exerted on his body when the rope becomes taut, but this force is moderated by the cushioning means **16**. In the forms shown, the loops **16** in the rope slip against the binding force of the seizing cord **50** or the buckle **52** with the double hooks and those absorb a part of the momentum. The part of the momentum remaining to be stopped, and applied through the rope to the body of the workman, is much less than the full force of momentum to be overcome. Moreover, usually the line of fall of the workman's body would be out of line with the point of attachment of the anchor **10** to the I-beam, and when the rope becomes taut, there would be a lateral moment (as with a pendulum) having the effect of further moderating the shock transmitted by the rope to the workman's body in overcoming the momentum of the fall. The strain or shock to be borne by the body of the workman is thereby much lessened. The anchor resists the force by reason of the engagement of one or the other side of the I-beam by one or the other of the hooks **23**, **24**, and on the opposite side to whichever side of the I-beam the workman falls. The downward pull of the rope, by reason of its attachment close to the plane of the bar **20** and at a point between the edges of the flange so that the rope **12** rides the edge of the flange, is to exert a pull almost exclusively parallel to the plane of the flange, and there is consequently no effective lifting force.

With the body attaching means **14** illustrated, the shock on the body of the falling workman would be further moderated. The portion of the rope which passes around the waist of the workman cannot slip and squeeze him by reason of the knot which passes through the eyes of the hooks **64**, **65** being a non-slipping knot. The broad belt **80** distributes the pressure of the rope to the body. The portion of the straps **90**, **91** which are attached to the belt **80**, as indicated at **86**, cause a considerable portion of the strain to be absorbed by the legs. The portion of the straps **90** which pass over his shoulders would likewise serve to absorb a portion of the strain in the event that the position of the falling workman should be head downward when the rope **12** becomes taut. Whatever the position the body of the falling workman is when the rope **12** becomes taut, the strain will be distributed to various portions of the body by the belt and the straps which pass over his shoulders and under his crotch, and across his trunk at back and front.

The link **95** attached to a portion of the rope **12** near the waist, and attached to the straps **90**, **91** adjacent the shoulder blades, should the workman fall head foremost, serves to pull the body of the workman to an upright position before the rope acts to completely counteract the momentum of the body of the workman, and enables the workman to better handle himself at this moment.

What is claimed is:

1. A safety-device for workmen on steel structures, comprising a rope adapted to be fastened to the body of the workman, and an anchor to which an end of said rope is attached, said anchor comprising a bar constructed to span an I-beam, crosswise, having hooks at its ends so constructed and arranged that the gap between the base of a hook and the tip of the opposite hook is approximately equal to the width of the flange of the beam, and means for stabilizing the bar so that the hooks thereon remain perpendicular to the plane of the flange.

2. A safety-device for workmen on steel structures, comprising a rope adapted to be fastened to the body of the workman, and an anchor to which an end of said rope is attached, said anchor comprising a bar constructed to span an I-beam, crosswise, having hooks at its ends constructed and arranged to engage the flange of the beam at opposite sides, and having wings extending laterally and constructed and arranged to bear on the flange of the beam and maintain the bar in a position in which the hooks thereon remain perpendicular to the plane of the flange.

3. A safety-device according to claim 2, said bar further having a means of attaching the rope thereto close to the plane of said bar, so that the weight of the rope hanging at one side of a beam acts nearly parallel to the plane of said bar to pull and maintain the base of the hook against the opposite edge of the flange.

4. A safety-device according to claim 2, wherein said wings are loops of bar-stock and the weight of the anchor is lightened consistent with adequate strength so that it may readily slide along the beam through the pull of the rope when the workman moves more than rope-length away from the anchor.

5. A safety-device according to claim 2, wherein the bar with the hooks is so constructed and arranged that the gap between the base of a hook and the tip of the opposite hook is approximately equal to the width of the flange of the beam.

ALBERT I. ROKE.