United States Patent

Renfroe

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[54] LIFTING CLAMP

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[52] **U.S. Cl.** **294/104,** 294/101

[51] **Int. Cl.** **B66c 1/48**

[58] **Field of Search** 294/101, 104

[56] **References Cited**

UNITED STATES PATENTS

3,262,731 7/1966 Renfroe 294/101

3,178,219 4/1965 Renfroe 294/104

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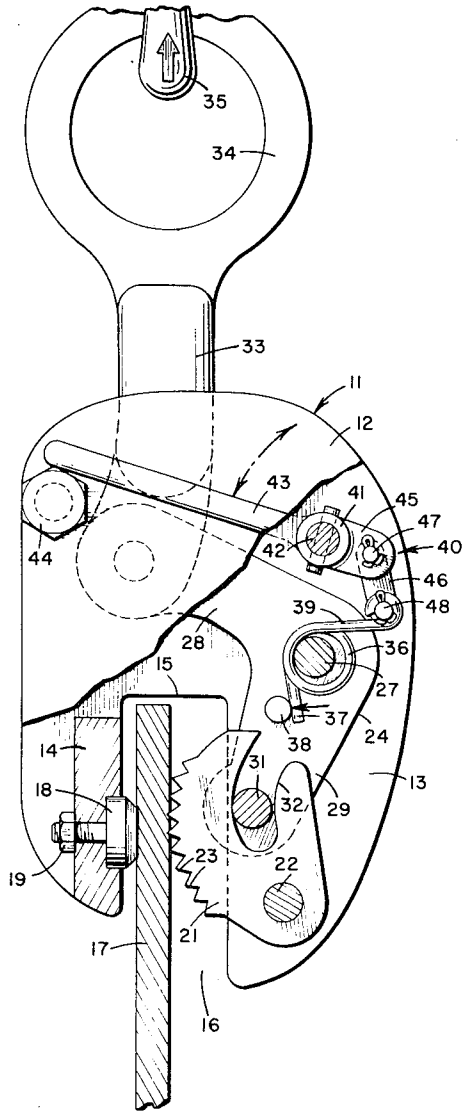
[57] **ABSTRACT**

A lifting clamp comprising a body having a slot to receive an article to be lifted, a pair of gripping jaws one of which is movable, a linkage connected to the movable jaw which includes a shackle and a bell crank lever pivotally mounted in the body, and a locking mechanism for resiliently retaining the jaws in a closed position, the lock being operated by a handle lever located outside of the clamp body and movable downwardly toward the slot to a locked position and upwardly and outwardly away from the slot to an unlocked position.

2 Claims, 3 Drawing Figures



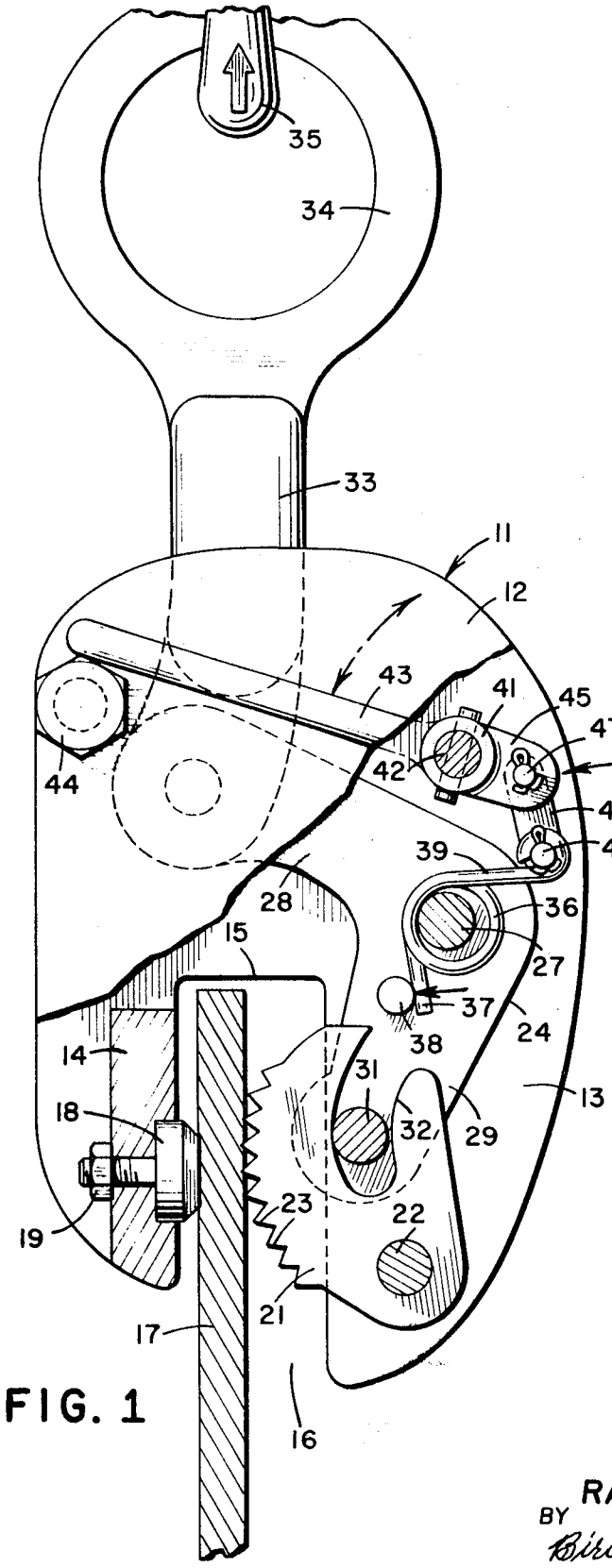


FIG. 1

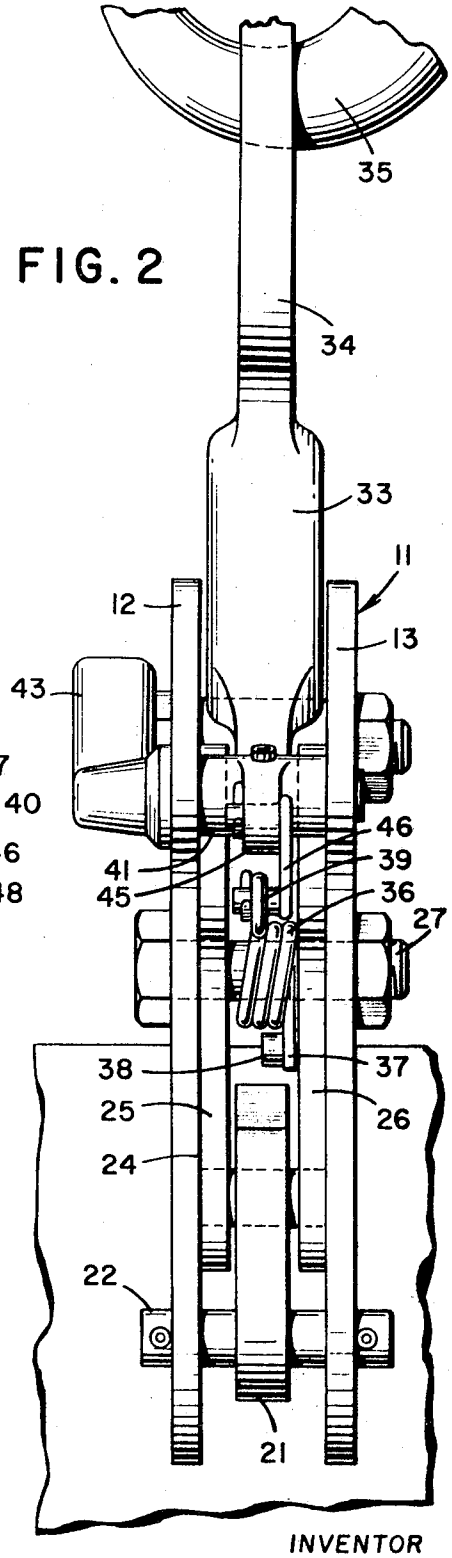


FIG. 2

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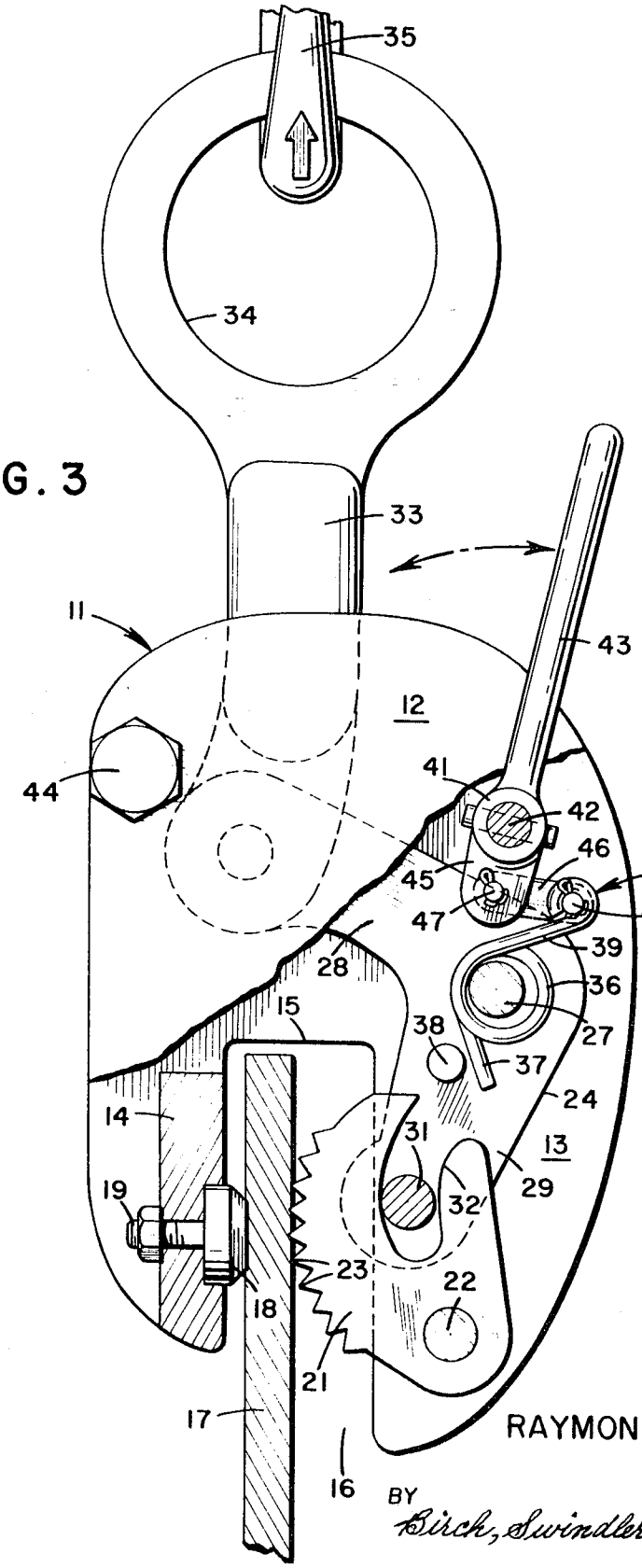
FIG. 3



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LIFTING CLAMP

BACKGROUND OF THE INVENTION

This invention relates to a lifting clamp with a bell crank lever linkage between a movable gripping jaw and a shackle as disclosed in Renfroe U.S. Pat. No. 2,916,321. It is common practice in the industry to employ lever operated locking mechanisms for lifting clamps, which resiliently retain the clamp in a closed or gripping relationship relative to the article being lifted. However, because of the nature of the bell crank linkage in the particular type of lifting clamp with which this invention is concerned, the industry has found it difficult to design an acceptable locking mechanism of the character described. Various attempts have been made, but none has been completely satisfactory. One prior art mechanism is disclosed, for example, in Renfroe U.S. Pat. No. 3,300,242. This mechanism is characterized by several disadvantages. For example, when the locking lever handle is moved toward lever locking position, it is moving upwardly away from the slot. This is dangerous because such upward movement tends to move the clamp off of the work and a careless operator can leave the clamp locked too close to the edge of an article for safety. Even if the operator is diligent to retain the clamp fully down upon the edge of the article, a considerable effort on his part is required to do so. Moreover, where the handle is moved downwardly toward an unlocked position, there is a greater danger that the shock of impact of the clamp with an extraneous body during the lifting operation will cause unlocking.

SUMMARY OF THE INVENTION

To overcome the disadvantage of the prior art, an object of this invention is to provide an improved lifting clamp of the character described with an effective locking mechanism which is safe and reliable.

A further object of the invention is to provide such a clamp with a locking mechanism which may be conveniently and easily operated.

Generally described, the invention relates to a lifting clamp which includes a normally upright clamp body having a pair of spaced side plates defining a slot with an open end at the lower end of said normally upright body and extending upwardly through the side plates to receive an article to be lifted. A first gripping jaw is mounted on the body on one side of the slot and a second gripping jaw is pivotally connected to the body on the other side of the slot for opening and closing movement away from and toward the first jaw respectively. A pivot pin is connected to the body side plates at a position spaced above the movable second jaw and a bell crank lever is pivotally mounted intermediate its ends on such pivot pin. The bell crank lever has its upper end extending across and above the slot and its lower end extending downwardly on the same side of the slot as the movable jaw. The shackle protrudes from the top of the body and is connected to the upper end of the bell crank lever with the lower end of the bell crank lever being connected to the movable gripping jaw so that movement of the shackle upwardly and downwardly relative to the body pivots the bell crank lever about its pivot pin to thereby rotate the movable jaw to effect the closing and opening movement respectively. There is also provided a locking assembly to resiliently lock the movable gripping jaw in a closed position. The locking assembly includes a coil spring which is mounted around the bell crank pivot pin with one end portion of the spring operatively engageable with the bell crank lever to rotate it in a direction to effect closing movement of the second gripping jaw when the spring is loaded, the spring having its opposite end portion protruding laterally outwardly from the bell crank pivot pin. A rock shaft is pivotally connected to the side plates at a location spaced above the bell crank pivot pin. A handle lever is mounted outside of one of the body side plates and is fixed to the rock shaft for pivotal movement downwardly toward the slot to a locked position extending inwardly from the rock shaft above and across the slot and entirely inside the periphery of the clamp body and outwardly away from the slot to an unlocked position. Stop means is provided to restrain the handle lever at the locked position. A lug is fixed at one end to the rock shaft. A link is connected by a first pivot at one end to the protruding end portion of the coil spring and by a second pivot at its other end to the other end of the lug. The combined length of the lug and the link are greater than the spacing between the rock shaft and the first pivot when the spring is unloaded, the lug and link thereby forming an over-center linkage connecting the rock shaft to the first pivot. The rock shaft retains the over-center linkage pointed outwardly slightly past dead center when the handle lever is in its locked position to load the spring and moves the over-center linkage inwardly past dead center when the handle lever is moved to its unlocked position to unload the spring.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front elevational view of a lifting clamp according to the present invention in its normal upright position with the clamp body partially broken away to show the bell crank linkage and the details of the lock mechanism;

FIG. **2** is a side view of such lifting clamp; and

FIG. **3** is a front elevational view similar to FIG. **1** with the lock mechanism in its open or unlocked position.

Referring to the drawings, there is illustrated a lifting clamp which includes a body **11** which preferably is fabricated of a single casting. The body **11** is provided with spaced parallel side plates **12** and **13** connected together by an integral web **14**. The clamp body **11** defines a slot **15** having an open bottom end **16** at the lower end of the normally upright clamp body **11**. The slot extends upwardly through both of said side plates **12** and **13** to receive therein an article to be lifted which is exemplified by the plate **17**.

Connected to the web **14** on one side of the slot **15** is a gripping jaw **18** which is mounted for swivelling movement about its own axis by a bolt **19** in the conventional manner. The swivel jaw **18** is fixed against axial movement and is characterized by sharp circular ridges on its outer face which grip the plate **17** or other article to be lifted. Opposing the fixed jaw **18** is a movable gripping jaw **21** which is connected to the clamp body **11** by a pivot pin **22** which is mounted between the side plates **12** and **13**. The movable jaw **21** has a plurality of sharp ridges **23** which grip the plate **17** in the usual manner. The movable jaw **21** is pivotally movable about the pin **22** for opening and closing movement away from and toward the fixed jaw **18** respectively. The closed position of the jaws is illustrated in FIGS. **1** and **3** where the jaws grip the article **17** between them. This pivotal movement of the jaw **21** is effected by a bell crank lever **24** which comprises a pair of spaced parallel plates **25** and **26** as best shown in FIG. **2**. The bell crank lever **24** is pivotally mounted intermediate its ends on a pivot pin **27** which is secured between the side plates **11** and **12**. The bell crank lever **24** has an upper end **28** which extends above and across the top of the slot **15** and a lower end **29** which extends downwardly between the side plates on the same side of the slot as the movable jaw **21**. The lower end **29** of the bell crank lever **24** is connected to the jaw **21** by a pin and slot connection which comprises a pin **31** on the bell crank lever movable in a curved slot **32** in the jaw **21**. The pin **31** and slot **32** provide a lost motion connection which alternatively could consist of a separate link connecting the bell crank lever and the jaw **21**. The upper end **28** of the bell crank lever **24** is pivotally connected to a shackle **33** which has the usual lifting eye **34**. The shackle protrudes in the conventional manner from the top of the clamp body for connection to a hoist **35** or the like. Upward and downward movement of the shackle relative to the clamp body **11** pivots the bell crank lever **24** about the pivot pin **27** to thereby rotate the gripping jaw **21** to effect the closing and opening movement respectively of the jaw **21** relative to the jaw **18**.

The clamp is characterized by a locking assembly to resiliently lock the movable gripping jaw **21** in a closed position. Such assembly includes a coil spring **36** having a coiled intermediate portion mounted around or encircling the bell crank pivot pin **27**. At one end of the spring **36** there is a protruding straight end portion **37** which engages a stop pin **38** on the bell crank lever **24**. When the spring is loaded, the end portion **37** engages the stop pin **38** and applies a resilient force tending to rotate the bell crank lever **24** in a clockwise direction as shown in FIGS. **2** and **3** to effect closing movement of the gripping jaw **21**. The spring **36** has a straight upper end portion **39** which protrudes laterally outwardly relative to the clamp body from the pivot pin **27**.

A manually operable mechanism is provided to load and unload the spring **36**. To that end, a rock shaft **41** is mounted at a position spaced above the bell crank pivot pin **27** and is connected by a pivot pin **42** to the side plates **12** and **13**. A handle lever **43** is mounted outside of the side plate **12** and is fixed to the pin **42** which in turn is fixed to the rockshaft **41**. The handle lever **43** is pivotable about the pin **42** between an open position as shown in FIG. **3** and a locked position as shown in FIG. **1**. A bolt head **44** mounted on the body **11** provides a stop to restrain the handle lever at the locked position against further movement in the locking direction. In that position, the handle lever **43** extends inwardly from the rock shaft **41** above and across the top of the slot **15** and is located entirely inside the periphery of the clamp body **11**. Accordingly, in the locked position no portion of the handle lever **43** extends outside of the clamp body to risk dislodgement by impact with an extraneous object during a lifting operation. It is also important that the handle lever **43** be moved downwardly toward the slot **15** as it is moved toward the locked position. Thus, the downward force required to lock the clamp also tends to urge the clamp downwardly onto the plate **17** to be lifted. In contrast, when the handle lever is lifted away from the slot, there is a tendency to pull the clamp off of the plate. A fair degree of force is required to move the handle to a locked position and if such movement were upward, it would require considerable effort even by a careful operator to prevent movement of the clamp at least partially off of the plate **17**. If the operator is careless, the result can be dislodgement to the point where the gripping jaws grip the extreme upper edge of the plate **17** thereby running the serious risk of complete dislodgement of the clamp during a lifting operation, particularly if an extraneous object is struck.

The rock shaft **41** is connected to the outer end of the spring **39** by an over-center linkage **40** which includes a lug **45** and a link **46**. One end of the lug **45** is fixed to the rock shaft **41** and may be an integral part thereof. The other end of the lug **45** is connected by a pivot pin **47** to one end of the link **46**. The other end of the link **46** is connected by a pivot pin **48** to the laterally protruding end **39** of the spring **36**. The combined lengths of the lug **45** and the link **46** is greater than the spacing between the rock shaft **41** and the pivot pin **48** when the spring is in a fully unloaded position. Thus, when the lug and link are longitudinally aligned in a dead center relation, the spring **36** exerts a force tending to compress the lug and link together. When the handle **43** is in its locked position, as shown in FIG. **1**, the over-center linkage is pointed outwardly, i.e., the pivot pin **47** is slightly outward of the line between the rock shaft **41** and the pivot pin **48**. Accordingly, a near maximum loading of the spring **36** occurs, which resiliently urges the jaw **21** to a closed position. When the handle lever **43** is rotated to the open position as shown in FIG. **3**, the over-center linkage passes dead center and becomes pointed inwardly, i.e. the pivot pin **47** is inward of the line between the rock shaft **41** and the pivot pin **48**. As the handle is moved to the unlocked position, in order to fully unload the spring the pivot pin **47** of the over-center linkage must be a substantial distance inward of dead center. During such unlocking movement, the lug **45** must clear the spring **36**. Accordingly, the length of the lug **45** is less than the spacing between the rock shaft **41** and the spring **36**. In the unlocked position, the collapsing of the over-center linkage permits the spring **36** to be unloaded thereby releasing the locking force exerted on the jaw **21** which can then be freely moved by operation of the shackle **33**.

There has been illustrated and described what is considered to be a preferred embodiment of the invention. However, various modifications may be made by persons skilled in the art without departing from the scope of the invention which is defined by the appended claims.

I claim:

1. In a lifting clamp which includes a normally upright clamp body having a pair of spaced side plates defining a slot with an open end at the lower end of said normally upright body and extending upwardly through said side plates to receive an article to be lifted, a first gripping jaw on said body on one side of said slot, a second gripping jaw pivotally connected to said body on the other side of said slot for opening and closing movement away from and toward said first jaw respectively, a pivot pin spaced above said second jaw and connected to said side plates, a bell crank lever pivotally mounted intermediate its ends on said pivot pin and having an upper end extending across and above said slot and a lower end extending downwardly on the same side on said slot as said second jaw, a shackle protruding from the top of said body and connected to the upper end of said bell crank lever with the lower end of said bell crank lever being connected to said second gripping jaw so that movement of said shackle upwardly and downwardly relative to said body pivots said bell crank lever about said pivot pin to thereby rotate said second gripping jaw to effect said closing and opening movement respectively, and a lock assembly to resiliently lock said second gripping jaw in a closed position, the improvement wherein said locking assembly comprises:

a coil spring mounted around said pivot pin and having one end portion operatively engageable with and to rotate said bell crank lever in a direction to effect closing movement of said second gripping jaw when said spring is loaded, said spring having its opposite end portion protruding laterally outwardly from said pivot pin, a rock shaft spaced above said pivot pin and pivotally connected to said side plates; a handle lever mounted outside of one of said side plates and fixed to said rock shaft for pivotal movement downwardly toward said slot to a locked position extending inwardly from said rock shaft above and across said slot and entirely inside the periphery of said body and upwardly and outwardly away from said slot to an unlocked position; stop means to restrain said handle lever at said locked position; a lug fixed at one end to said rock shaft; a link connected at one end by a first pivot to said protruding end portion and at the other end by a second pivot to the other end of said lug; the combined lengths of said lug and said link being greater than the spacing between said rock shaft and said first pivot when said spring is unloaded, said lug and said link thereby forming an over-center linkage connecting said rock shaft to said first pivot, said rock shaft retaining said over-center linkage pointed outwardly slightly past dead center when said handle is in said locked position to load said spring and moving said over-center linkage inwardly past dead center when said handle is moved to said unlocked position to unload said spring.

2. A lifting clamp as recited in claim **1** wherein said lug is moved past said spring as said handle is moved to said unlocked position, the length of said lug being less than the spacing between said rock shaft and said spring.

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