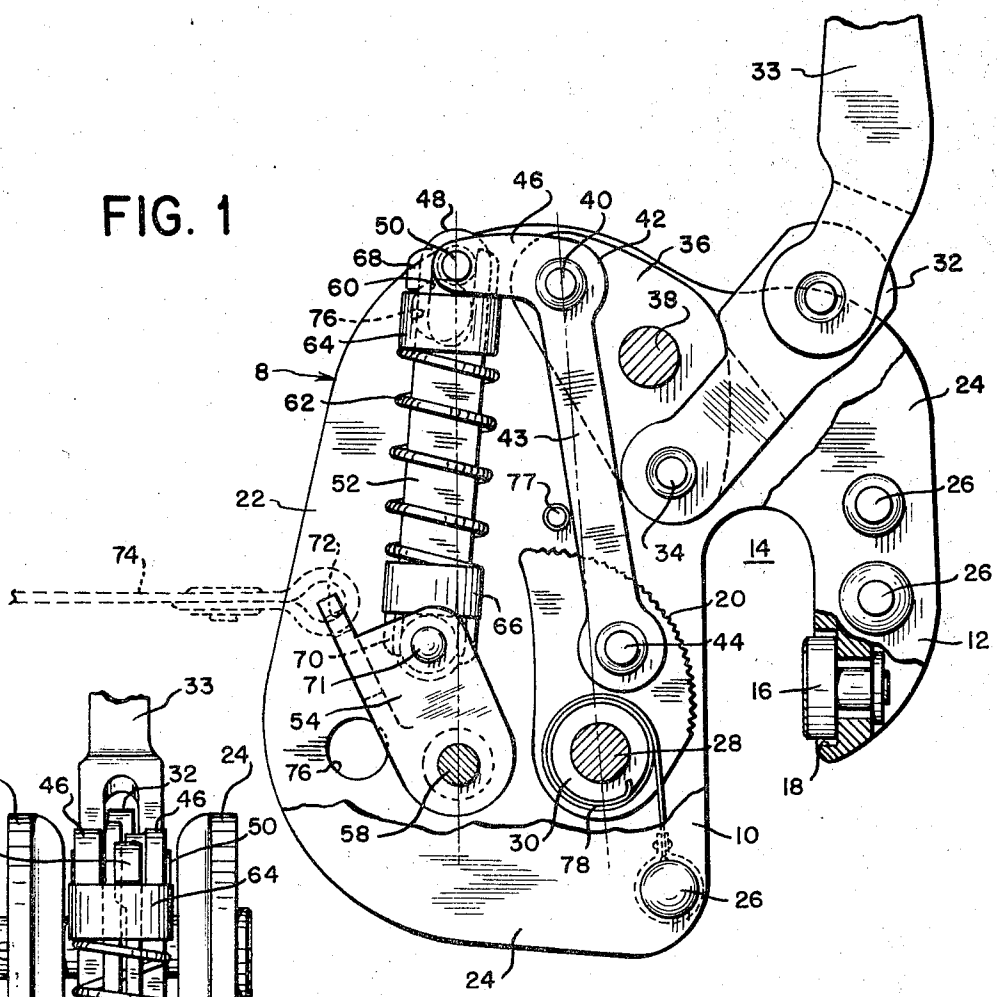
April 29, 1969 E. M. GARDNER 3,441,308

PLATE LIFTING CLAMP WITH LOCKING MECHANISM

Filed May 25, 1967 Sheet 1 of 2

FIG. 1



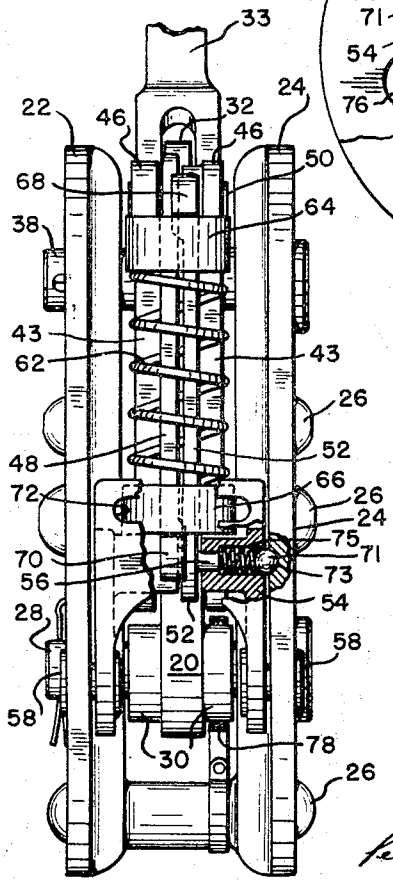


FIG. 2

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FIG. 3

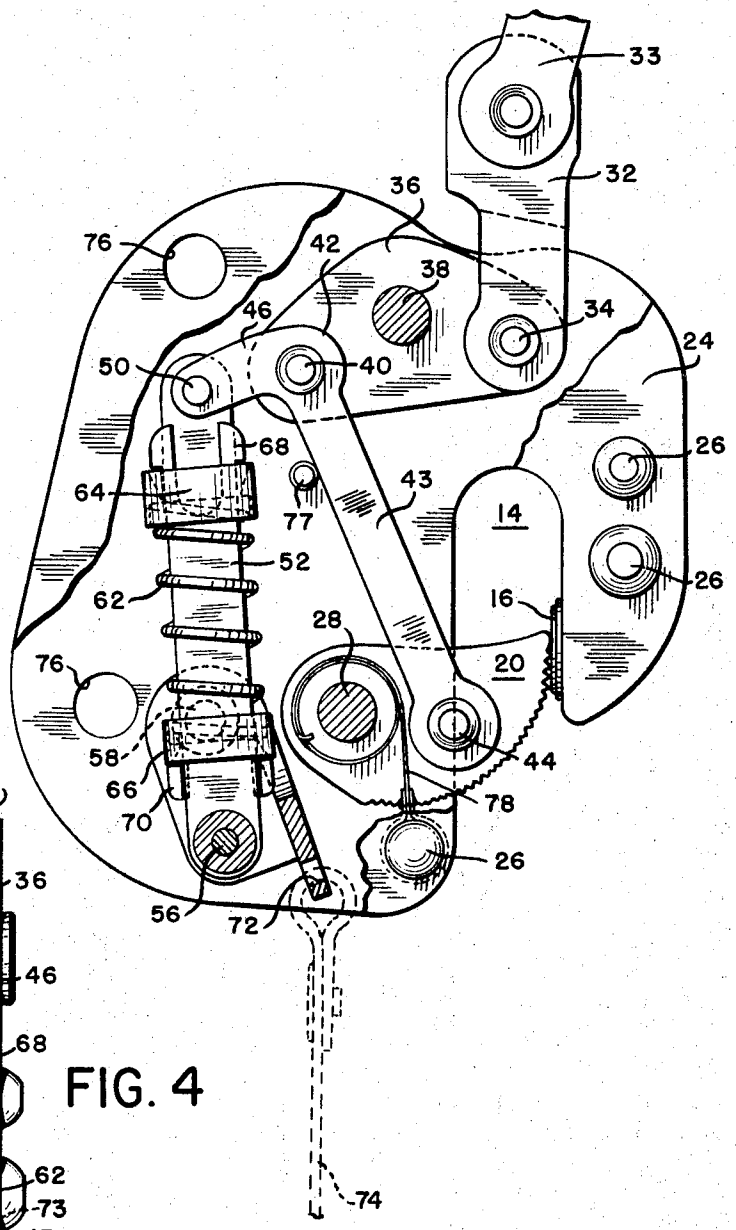

FIG. 4

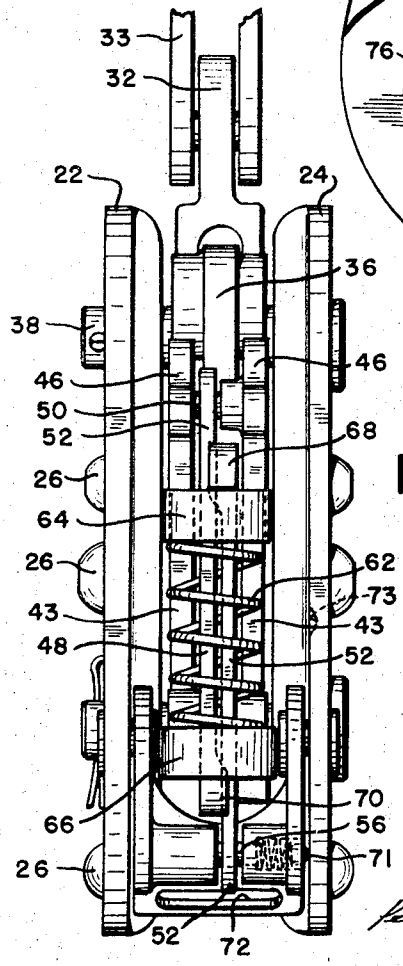

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PLATE LIFTING CLAMP WITH LOCKING MECHANISM

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Int. Cl. B66c 1/48
U.S. Cl. 294—101 14 Claims

ABSTRACT OF THE DISCLOSURE

The plate lifting clamp disclosed in the present application includes a clamp body provided with a pivoted gripping cam rotatable across a slot into and out of engagement with a plate. The cam is attached to and rotated by a connecting means pivoted on one end of a fulcrumed radius link, the other end of which is connected to a lifting shackle. In this construction a cam-actuating and locking mechanism is provided including a coil spring maintained continuously under compression and used to actuate one arm of a bell crank lever fulcrumed on the radius link, the other arm of which provides the connecting means therefrom to the gripping cam, and an actuating lever pivoted to the body of the clamp and to the spring mechanism, and adapted to effect rotation of the cam to a retracted position and to rotate the cam to a locked plate-gripping position. The clamp also includes a direct spring on the cam biasing it to plate-gripping position.

Background of the invention

My invention constitutes improvements in known types of steel plate-gripping and lifting clamps, as illustrated in my U.S. Patents 2,852,300 and 3,189,377; and certain other U.S. patents, including Nos. 2,446,610 and 2,654,630. All of these patents, except the first, disclose a spring means and lever mechanism for biasing a gripping cam to at least its plate-gripping position.

Summary of the invention

My invention relates to improvements in clamps for lifting steel plates, such clamps being generally of the type including a heavy forged steel body provided with a plate-receiving slot across which a pivoted gripping cam is swung into engagement with the plate to be lifted. This cam preferably faces a gripping pad across the slot, and after the plate is engaged by the gripping cam, a lifting linkage is arranged to provide a force on the gripping cam through a lifting shackle, the leverage of a radius link and a connecting means between the radius link and the cam.

In accordance with my invention, I provide a cam-actuating and locking mechanism for latching the cam in a retracted position and for locking it in a plate-engaging position, such mechanism comprising a spring assembly so devised that the spring is always under compression and in which it is compressed to either obtain a pushing or pulling force on the gripping cam. Advantageously the spring is under a predetermined compression in an area lying between the two areas where the spring assembly is operating with directly opposite forces to actuate the cam to its respective positions. Between the two areas the spring is compressed and is at its stable point.

According to the preferred construction, the connecting means between the radius link and the cam is one arm of a bell crank lever, the other arm of which projects at an angle approximating 90° but which may vary between 75° and 110°. The spring assembly is pivoted at one end to the projecting arm of the bell crank lever and at the other end to the movable end of an actuating lever which is mounted on a fixed pivot in the body of the clamp. When the actuating lever is swung to an upper position, force is applied to the projecting arm of the bell crank and the cam is moved to its retracted position. When the actuating lever is swung around through 180°, more or less, the spring mechanism applies a pulling force to the projecting arm of the bell crank and actuates the gripping cam to a plate-engaging position where the actuating lever is locked by going over dead center so that the spring under compression continuously applies a gripping force to the cam.

Another feature of the preferred construction is the provision of a direct spring to constantly bias and force the gripping cam against the steel plate, unless overcome by the operator. This makes the clamp foolproof in case the operator should fail to apply the actuating lever as he should after locating the clamp on a plate to be lifted, as for example when the clamp is applied to lift a plate from a horizontal position. When the actuating lever is merely latched with a friction catch when the cam is in its retracted position and not locked, according to the invention, the lifting force applied to the clamp is sufficient to unlatch the actuating lever and permit the full force of the direct spring to move the cam into a plate-gripping position.

The friction catch used on the actuating lever is readily overcome by the lifting force and even though the operator has failed to throw the lever to its locked gripping position, the additional spring on the cam will avoid any accident which might occur from the operator's failure.

The primary object of my invention is to provide an effective cam-actuating mechanism for a plate-lifting clamp which will avoid the difficulties encountered with tension springs of prior clamps and the dangers encountered from slippage, breakage of springs and the failure of an operator to apply the actuating lever to grip a plate.

A further object is to provide an effective clamp which will not be released from a plate, even if the spring is damaged or broken. A further object of the invention is to provide a new cam-actuating mechanism with manual lock and release which is positively locked to hold the gripping cam in the plate-engaging position.

All of the actuating and locking mechanisms of my clamp are protected by the body of the clamp and are arranged to be actuated and operated in a simple manner by hand without the use of more force than can be applied by one's fingers. The entire mechanism, including the actuating lever, the compression spring unit, the bell crank lever and the direct cam spring cooperate to provide an effective, safe and foolproof construction in which the direct spring acts alone in case of operator or other failure and with the compression spring to bias the cam to plate-engaging position. Other advantages will be appreciated by those who use the improved clamp.

Brief description of the drawings

My invention is described more in detail hereinafter in connection with the accompanying drawings illustrating a single embodiment and forming a part of this application.

In the drawings:

FIG. 1 is an elevational view with parts in section and one side plate broken away or removed to show the internal structure of the clamp with the gripping cam in retracted latched position;

FIG. 2 is an elevational view looking from the left toward the showing of the clamp in FIG. 1, particularly to show the compression spring and actuating mechanism;

FIG. 3 is a view similar to that of FIG. 1, showing the

gripping cam biased to and locked in a plate-gripping position; and

FIG. 4 is a view similar to that of FIG. 2 looking from the left toward the showing of the clamp in FIG. 3 and illustrating the position of the compression and actuating mechanism when the cam is in gripping position.

Description of preferred embodiment

Referring to the figures of the drawings, the plate-lifting clamp shown therein comprises a single embodiment including the combinations and improvements of the present invention. The clamp comprises a clamp body 8 in the form of a U-shaped structure including jaws 10 and 12, the latter of which is shorter than the former. These jaws face each other to provide a space or elongated slot 14 in which a plate to be gripped and lifted is received. The short jaw 12 is provided with a serrated gripping pad 16, of a known type, slidable up and down in a slot 18 and which cooperates with a gripping cam 20 also of known type pivotally mounted in the jaw 10.

The body 8 of the clamp is made up of a pair of spaced face plates 22 and 24 held in spaced relation by some of the mechanisms and by spacer blocks (not shown), and secured together by rivets, such as the lower and upper rivets 26 and the end pins of the radius link and the hub of the gripping cam 20.

The gripping cam 20 is appropriately mounted between plates 22 and 24 in the longer jaw 10 and pivotally mounted on a pin 28 extending through the plates 22 and 24. The cam 20 includes hub portions 30 which aid in spacing the plates 22 and 24.

The clamp is provided with a lifting shackle 32 connected to a lifting eye 33 and pivoted by a pin 34 to one end of a radius link or lever 36 which in turn is fulcrumed on a pivot pin 38 extending through the plates 22 and 24 and located in a position above and to the left of the space 14. According to a feature of my invention the other end of the radius link 36 carries pivot pin 40 providing the fulcrum point of a bell crank lever 42 comprised of two similar parallel members on the respective sides of the radius link 36 and cam 20. The bell crank 42 consists of two arms, an arm 43 extending downwardly and pivoted to the cam 20 on a pin 44, at a point intermediate the tip of the cam and its pivot pin 28, and an arm 46 at the upper end of the arm 43 extending outwardly from the pivot pin 40 at an angle of about 90° with respect to arm 43 or to a straight line through the pins 40 and 44. The arm 43 comprises the connecting means between the radius link 36 and the gripping cam 20.

The arm 46 of the bell crank 42 is utilized as an element of the cam-actuating and locking mechanism and, accordingly, its outer end is connected to the upper end of a link 48 of a pair of cooperating expander links by means of a pivot pin 50 which extends through the upper end of link 48 and the pair of members of the arm 46 which are located on the respective sides of the link 48. The other expander link, 52 extends along parallel to the link 48 and the ends of the pair of links are in slidable relation to each other. The lower ends of the links extend into a channel-shaped hasp actuating lever 54 with link 52 being connected by a pivot pin 56 to the sides of the channel-shaped lever 54 in the manner shown in FIG. 2. This lever is pivotally mounted in the body of the clamp by means of pivot pins or rivets 58 which pivot the respective sides of the lever 54 to the respective adjacent plates 22 and 24, on the same axis, back of and spaced from pin 28 and cam 20, as shown in FIGS. 1 and 2.

The lower end of the expander link 48 and the upper end of the expander link 52 have similar structures in that they are each provided with an open ended slot 60, that for link 52 straddling a hub on arm 46 around pin 50, while that for the link 48 straddles a similar hub on lever 54 around pin 56. The slots 60 permit the links 48 and 52 to slide longitudinally with respect to each other over a limited range within which they are controlled and

biased in opposite directions by a strong compression spring 62 which surrounds the links 48 and 52 and at each end bears against upper and lower rings or bands 64 and 66, which respectively abut against projecting end stops 68 on both edges of the link 52 and end stops 70 on both edges of the lower end of the link 48.

The stops 68 and 70, as shown, are in pairs and the stops of each pair extend over and slide along the respective edges of the adjacent link. For example, the stops 68 extend over and along the edges of the link 48. In FIGS. 1 and 2 the ring 64 bears against the under edges of the arm 46, while the ring 66 bears against the inwardly-extending hubs of the lever 54, which receive the pivot pin 56.

The actuating lever 54 is swingable on the pivot axis of the rivets 58 and is provided with a releasable latch located in a side wall at the position of the pin 56, which extends only partly into the hub on the side wall of the lever 54. FIG. 2 shows the latch in section as comprising a detent ball 71 receivable in a circular recess 73 located on the inside of plate 24 to latch the lever 54 when in the position shown in FIGS. 1 and 2. The ball 71 is biased by a spring 75 and the ball and spring are located in an enlarged opening which extends into the hub of the lever 54, as shown. The outward movement of the ball is limited by peening the rim in a known manner.

The mechanisms are shown in FIG. 1 with the cam 20 in retracted position but with the pin 44 to the right of a line running through the axes of pins 28 and 40, so that the cam is quite readily movable toward closed position. Similarly, the actuating lever 54 is movable only to the position indicated where the detent ball 71 engages in the recess 73. In this position the detent ball and the axis of the pivot pin 56 are to the left of a line extending through the axes of pins 50 and 58. The movement of the cam 20 and arm 43 to retracted position is limited by a stop either for the cam or for the arm 43, such as the stop pin 77.

The free end of the actuating lever 54 is provided with a slot 72 for receiving a strap 74 for remote operation. When the lever 54 is moved to the position shown in FIGS. 1 and 2, as for example, when the shackle 32 is relaxed and the clamp is to be removed from a steel plate, the compression spring 62 is further compressed and acts on the outer end of the arm 46 through the ring 64 to in turn rotate the bell crank lever 42, and the cam 20 on its pin 28 to the position shown in FIGS. 1 and 2. This position is achieved when the spring-actuated detent ball 71 engages the recess 73 holding the actuating lever 54 in its most open position needed to hold the cam 20 in its maximum open position.

The constructions and relationships described above in connection with FIGS. 1 and 2 are important with respect to making the clamp foolproof in the event an operator should forget to actuate lever 54 or lock the clamp to the position shown in FIG. 3, for example, when applying it to a plate which is to be lifted from a horizontal position. If the actuating mechanism and cam were arranged to be locked in overcenter and unyielding in open position and the clamp were placed on a horizontal plate without being released, the plate would slip out as soon as it is lifted to a position above a 45° angle. It might easily fall on the operator's feet or legs or injure someone else. Furthermore, the clamp itself might swing off and cause some serious injury.

However, with the arrangement as shown in FIGS. 1 and 2, a pull on the lifting shackle will automatically release the actuating lever 54, held only by the detent ball, and actuate the cam to gripping position through the leverage provided by the radius link 36 and the arm 43. This lifting of a plate from the horizontal position applies a downward force to the arm 46 and causes the lever 54 to be released because it was merely latched by the detent ball. The force applied is sufficient to break the hold of the ball 71, which is regulated to break with a

strong hand pull, and yet not sufficient to break the hold with ordinary jolting of the clamp hanging on the crane. Therefore, the cam would engage and grip the plate because of the force applied through the radius link **36**, and the arm **43** connected to the cam **20**.

A further feature of the invention cooperating with the arrangement described above with respect to FIGS. 1 and 2, increases the safety of the clamp and provides a further precaution to make it foolproof. If the operator fails to actuate the lever **54** from the position shown in FIG. 1, and the clamp is placed on a horizontal plate, the lifting shackle and radius link overcome the detent ball **71** and cause the cam to engage the plate. In this construction an additional feature is included comprising a clock type spring which continuously biases the cam **20** toward its plate-engaging position. This spring shown at **78** in FIGS. 1 and 2 has one end attached to the hub **30** of the cam **20**, while its other end is looped around the lower rivet **26** and fastened. A second spring **78** may be provided on the other side of the cam where greater force is required, as for example with extra large clamps.

The clock type spring **78** continuously applies a bias or force against the plate once the cam has been released in the manner described above. The safety of the clamp is, therefore, increased because regardless of any relaxation on the shackle, the force of the spring **78** maintains the cam in gripping engagement with the plate.

When a lifted plate is put down and the clamp released, by actuation of the lever **54** clockwise to the position shown in FIG. 1, the operator first overcomes the force of the spring **78** and then the force of the spring **62**, but once the ball detent **71** is latched into the groove **73**, it is designed to and can hold the cam **20** and the lever **54** against the force of both springs **62** and **78**. Under certain circumstances the lever **54** may be used merely to release the pressure of the spring **78**, for example when removing the clamp from a plate, or the lever **54** may be used as explained above to swing the cam **20** to its full open position permitted by the stop **77** where it is held by the spring-biased ball detent **71**.

During the swinging of the actuating lever **54** in a clockwise direction, as described above, it initially brings the arm **43** against the stop **77**. Thereafter, the lever **54** further compresses the spring **62** causing the bosses around the pin **56** to act on the ring **66** and the ring **64** to act on the end of the arm **46**, to compress the spring **62** to a point beyond its stabilized position and cause the pins **50** and **56** to come closer together. Depending upon the relative proportions of the parts of the spring mechanism, this compression of the spring **62** beyond its stabilized position may force the lugs **68** and **70** to leave the rings **64** and **66** and force the pins **50** and **56** to enter the deep slots **60** in the links **48** and **52**. In certain positions the lugs **68** and **70** apply a pulling force on the pins **50** and **56**, but as described, the pulling force has been reversed and a pushing force reacts upwardly on the arm **46** to hold the arm **43** against the stop **77** and the cam **20** in open position.

When the pins **50** and **56** are moved closer together than the normal distance, namely where the spring **62** is under strong precompression, the force of further spring compression pushes the pins apart. However, when the pins **50** and **56** are moved farther apart than the predetermined length, the force of further spring compression is in the opposite direction, or in a direction to pull the pins **50** and **56** toward each other.

A special advantage of the unique spring assembly described above is that one does not have a fixed length when the actuating lever **54** is holding the cam **20** in retracted position. If the neutral position where the distance between the pins **50** and **56** remains approximately fixed, as when the spring system is stabilized, and this distance is slightly too great for the retracted position, there is an automatic adjustment of the spring mechanism because the pins **50** and **56** can be forced closer together in the manner described above. The cam **20** is firmly held to retracted or open position by the prestressed spring **62**, even though the weight of the clamp hanging on the shackle and the sprinv **78** are acting to, or attempting to unlatch the lever **54** and move the cam **20** to plate-engaging position.

FIGS. 3 and 4 show the position of the cam-actuating mechanism after the cam is moved to an extreme position for engaging a steel plate. As shown in these views the swinging of the lever **54** from the position shown in FIG. 1 to that shown in FIG. 3 moves the pivot pin **56** around to the opposite side of the pivot axis of the short pins **58**, by which the lever **54** is pivoted to the side plates **22** and **24** of the clamp. This movement applies a pull through the pin **56** and link **52** mounted thereon, which in turn additionally compresses the spring **62**. The links **48** and **52** slide with respect to each other and consequently move the rings **64** and **66** closer together, thereby applying a force against the stops **68** and **70** which in turn apply a pull on the arm **46** to cause rotation of the gripping cam **20** to about the position shown in FIG. 3.

In some intermediate position across the slot **14** the cam **20** is locked against a plate received in the slot. Locking is completed by the fact that the axis of the pin **56** in FIG. 3 is moved counterclockwise across a straight line through the axes of the pins **50** and **58**. This overcenter lock is maintained even though the cam is at some intermediate position against a plate. However, the force of compression spring **62** and that of the spring **78** are applied against the cam and plate.

When a plate to be lifted is being received into the slot **14** and the clamp is being let down on the plate, the locking lever **54** is released and the spring **78** immediately rotates the cam **20** against the plate. The lever **54** is then positively operated and the pressure in applying the locking lever, together with the force of spring **78** also pushes and holds the clamp on the plate.

After a steel plate is locked in slot **14** with the cam actuating and locking mechanism in the position shown in FIG. 3, a lifting force applied to the shackle **32** increases the pressure on the steel plate through the leverage including the radius link **36** and the arm **43**. It will be understood that the presence of a steel plate in the slot **14** will result in the pivot pins **40** and **50** being at a higher level than that shown in FIG. 3. Nevertheless, the combined force of the springs continuously applies pressure to the gripping cam **20**, and with a steel plate in slot **14** there will even be further compression of the spring **62** because of the increase in distance between the pins **50** and **56**.

The spring assembly illustrated in the drawings and described above compresses the spring **62** to apply a tension or pulling force on the arm **46**. The spring is also compressed to apply a force against the end portion of the arm **46** as in FIG. 1. These compressions of the spring **62** are both from a fixed and predetermined dimension which lies between the two areas involved where the spring assembly is operating with directly opposite forces and where the spring **62** at this stable point is prestressed.

The compression spring **62** and the clock type spring **78** cooperate with each other and pull together to hold the cam **20** really locked tightly against a plate in the slot **14**. While this is true the springs and actuating mechanism are easily locked and released, even though the springs are very powerful. The locking is easy, due to the fact that the work of locking is performed in two operations, the first of which is when the operator unlocks the coiling up of the clock type spring, so that work is later applied to the locking operation. In the second operation when the operator uses the locking lever **54**, he has it at a point where he can get a tremendous leverage advantage due to the heaviest pull occurring as it goes over dead center in a counterclockwise direction. In this operation and at the same time, the clock type

spring is also helping hold the cam in gripping position. The unlocking of the mechanism is easy because the compression spring **62** is first released before the operator even starts to wind up the clock type spring **78**. Release of the cam **20** is also facilitated by the fact that the gripping pad **16** is slidable in the slot **18**. When the plate is set down and the release is being effected, the clamp body moves downwardly relative to the plate, the pad **16** and the cam **20**, which materially aids the releasing operation.

A feature of the invention included in the clamp illustrated in the drawings is that the spring-actuating mechanism includes the slidable expander links **48** and **52** enclosed within the spring **62** and held in place by the spring and the rings **64** and **66**. Springs are sometimes broken and consequently provision is made for quick replacement not only of a broken compression spring but also of one or both of the expander links **48** and **52**. In any case these links must be removed in order to replace a spring and, therefore, the side plates of the clamp are provided with upper and lower through openings **76**, which respectively provide access to the pins **50** and **56**. The removal of these pins will completely release the expander links, spring **62** and rings.

I claim:

1. In a clamp of the type used for lifting steel plates including a body having spaced opposed projecting jaws defining a U-shaped structure providing a plate-receiving space between the jaws open at the projecting ends thereof for receiving a steel plate to be gripped and lifted by the clamp,

(a) a plate gripping means on one of said jaws facing the other jaw across said space,

(b) a plate-gripping cam pivoted in said other jaw adjacent to said space and having an arcuate gripping surface facing toward said gripping means,

(c) a leverage mechanism located in the body of the clamp including a radius link fulcrumed on a pivot pin in the body of the clamp spaced from said gripping cam,

(d) a lifting connector attached to one end of said radius link, and

(e) a cam-connecting means pivoted to said cam by a first pivot pin located intermediate the pivot axis of the cam and its outer end and connected by a second pivot pin to the other end portion of said radius link,

wherein the improvement comprises:

(f) mechanism for actuating the gripping cam and advancing it in one direction for forcing the gripping cam to a position in engagement with a plate to be lifted and to a retracted position,

(g) said actuating mechanism including a compression spring unit extending in the general direction of the cam connecting means and having one end connected by a connecting means with said other end portion of said radius link for acting on said cam connecting means connected to the radius link, and

(h) an actuating and locking lever pivotally connected to the body of the clamp and connected with the other end of the compression spring unit for applying compression spring pressure to the leverage mechanism and gripping cam,

(i) said lever being swingable on its pivot to move the gripping cam to either of said positions.

2. A clamp as claimed in claim **1**, wherein the compression spring unit includes a compression spring, means for maintaining said spring continuously under compression when the lever is swung to move the gripping cam to either of said positions.

3. A clamp as claimed in claim **1**, wherein the actuating lever pivotally mounted in the body of the clamp is swingable to either of said two positions and is adapted to move the cam respectively to a retracted position for which the lever is releasably latched and to a plate-engaging position for which the lever is locked in overcenter position.

4. A clamp as claimed in claim **1**, wherein the actuating lever is pivoted in the body of the clamp back of the cam, a spring-biased readily releasable latch means on said lever latching on the body of the clamp to hold the cam in a readily releasable retracted position, said lever and cam being releasable by the application of a lifting force on the radius link.

5. A clamp as claimed in claim **1**, wherein the actuating lever when pressure is applied to the free end thereof in one direction forces the cam into engagement with a plate to be lifted, said pressure prior to the movement over dead center of the locking mechanism pushes the clamp body so that it is held and forced toward the plate which is entered into the space between the jaws of the clamp.

6. A clamp as claimed in claim **3**, wherein a direct acting spring is connected to said cam and which continuously biases the cam toward plate-gripping position, a latch means for latching the actuating lever in the retracted position of the cam, said latch means and cam being releasable by applying a predetermined pull on the radius link in excess of that necessary to lift the clamp alone, whereby a clamp placed on a plate to be lifted but without operating the actuating lever is automatically gripped onto the plate by release of the latch means and the force of the direct spring on the cam.

7. In a clamp of the type used for lifting steel plates including a body having spaced opposed projecting jaws defining a U-shaped structure providing a plate-receiving space between the jaws open at the projecting ends thereof for receiving a steel plate to be gripped and lifted by the clamp,

(a) a plate gripping means on one of said jaws facing the other jaw across said space,

(b) a plate-gripping cam pivoted in said other jaw adjacent to said space and having an arcuate gripping surface facing toward said gripping means,

(c) a leverage mechanism located in the body of the clamp including a radius link fulcrumed on a pivot pin in the body of the clamp spaced from said gripping cam, and

(d) a lifting connector attached to one end of said radius link,

wherein the improvement comprises:

(e) a cam connecting and actuating mechanism including a bell crank lever pivoted to the other end portion of said radius link, one arm of the bell crank lever being pivoted to the cam at a point located intermediate the pivot axis of the cam and its outer end thereby connecting the cam to the radius link,

(f) the other arm of the bell crank lever extending outwardly from the radius link,

(g) said actuating mechanism also including a compression spring unit connected at one end to said other arm of the bell crank lever, and

(h) an actuating lever pivoted to the body of the clamp and connected to the other end of the compression spring unit for applying compression spring pressure to the leverage mechanism and gripping cam.

8. A clamp as claimed in claim **7**, wherein the actuating lever is pivoted in the body of the clamp back of the cam, a spring-biased readily releasable latch means on said lever latching on the body of the clamp to hold the cam in a readily releasable retracted position, said lever and cam being releasable by the application of a lifting force on the radius link.

9. A clamp as claimed in claim **7**, wherein the point of connection of the compression spring unit to the actuating lever is movable counterclockwise into an overcenter locking position with respect to a line through the pivot axis of the actuating lever and the point of connection of the spring with the projecting arm of the bell crank

lever for simultaneously rotating the cam to a plate-engaging position.

10. A clamp as claimed in claim **7**, wherein the arms of the bell crank lever are at approximately 90° with respect to each other.

11. A clamp as claimed in claim **7**, wherein the compression spring is a coil spring, and wherein the compression spring unit including a pair of expander links located within the coil spring and slidable with respect to each other, opposite respective ends of said expander links being pivoted on pivot pins respectively to the actuating lever and to the outer end of the projecting arm of the bell crank lever, each expander link at its end opposite its pivoted end being slidable on the other expander link and including means engaging the outer end of the coil spring thereat, whereby the power of said coil spring under compression biases said links lengthwise in opposite directions with respect to each other.

12. A clamp as claimed in claim **11**, wherein the slidable end of each expander link is provided with an end slot for receiving the one of said pivot pins on which the other expander link is pivoted.

13. A clamp as claimed in claim **11**, wherein the spring unit including the coil spring and the expander links is readily removable and replaceable by removing the pivot pins by which respective ends of the expander links are

respectively pivoted to the actuating lever and the projecting arm of the bell crank lever.

14. A clamp as claimed in claim **11**, wherein the means on the respective ends of the respective expander links for engaging the ends of the coil spring includes a projection, and a ring means at each end of the coil spring bearing against the projections in at least certain stressed positions of the compression spring unit.

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R. D. GUIOD, *Assistant Examiner.*

U.S. Cl. X.R.

294—104