July 28, 1953 C. H. GMOSER ET AL 2,647,007

ADJUSTABLE LIFTING CLAMP

Filed May 18, 1950 2 Sheets-Sheet 1

FIG. 1

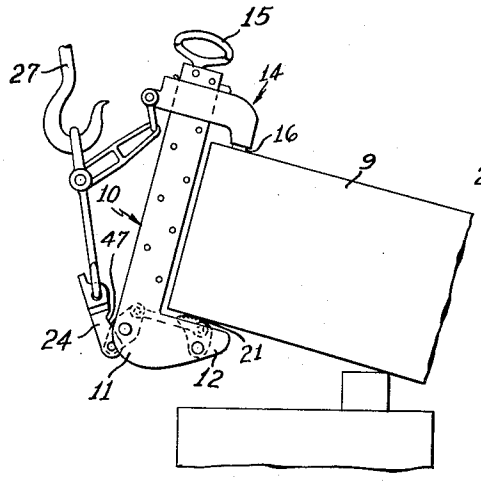


FIG. 2

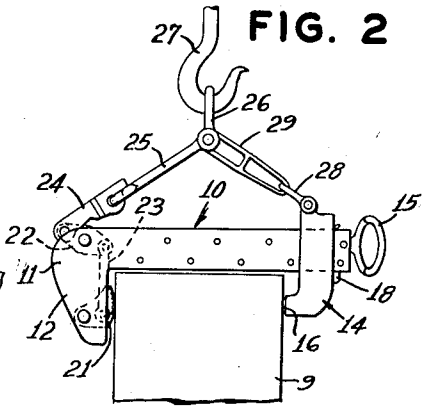


FIG. 3

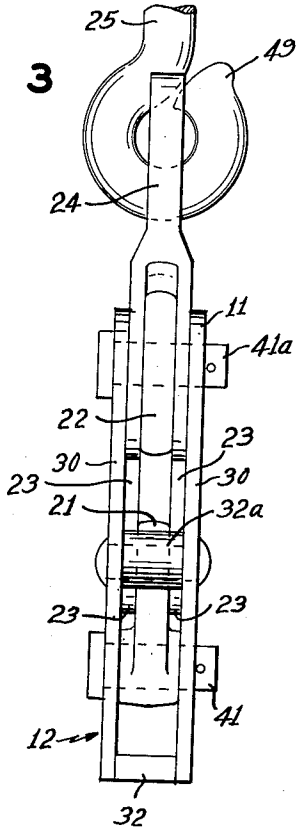
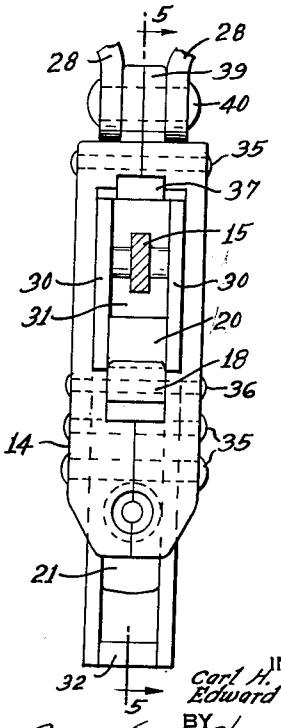


FIG. 4



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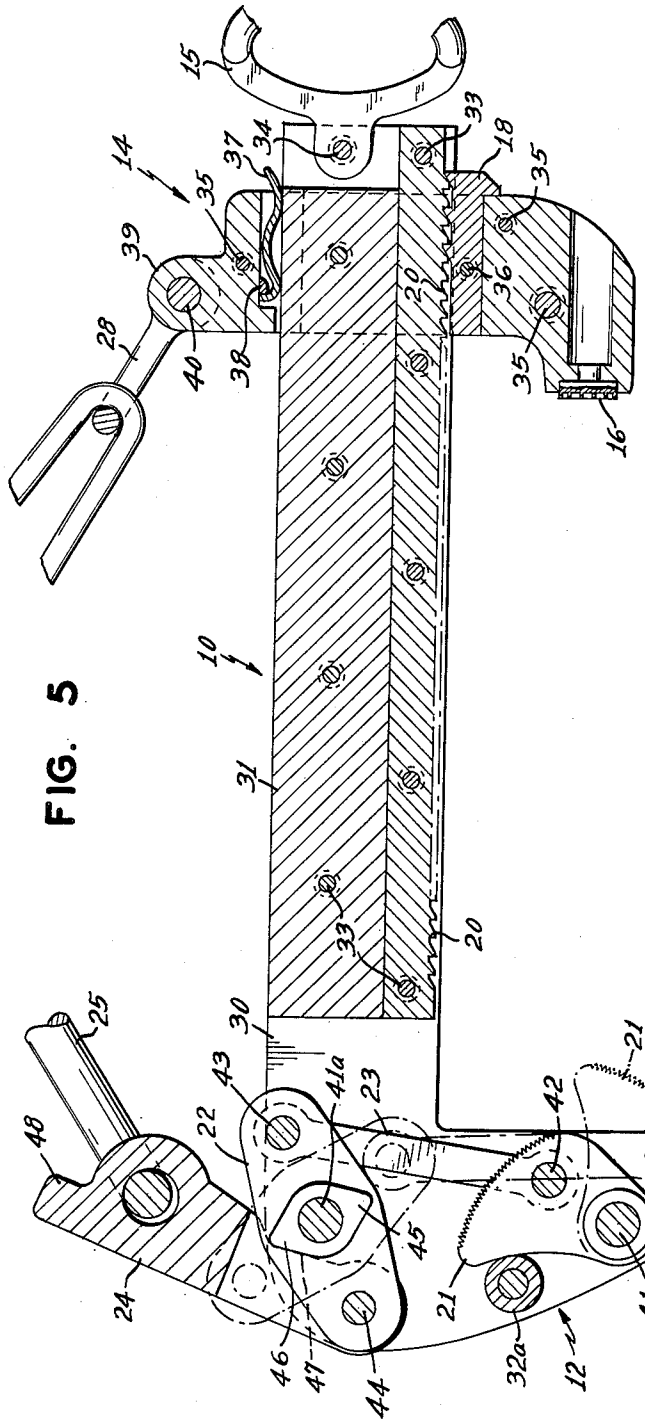


FIG. 5

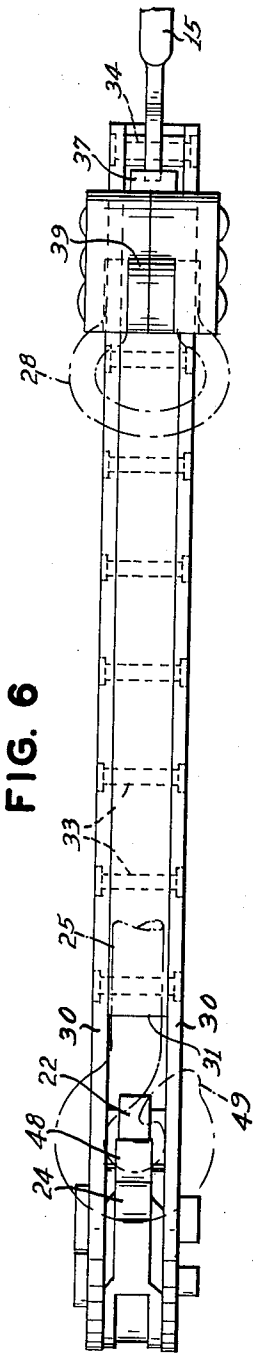


FIG. 6

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ADJUSTABLE LIFTING CLAMP

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3 Claims. (Cl. 294—81)

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Our invention relates to an improved adjustable lifting clamp particularly adapted to grip and lift loads of the order of one to three tons or more.

Our improved adjustable lifting clamp is particularly adapted for handling loads of the type of steel billets, castings, forgings, beams and other members. A billet, for example, which may be eight inches or more through at its smallest dimension, is a difficult member to grip and handle. Our improved device is adapted to grip and lift members of this type from either a horizontal, a vertical, or an intermediate position.

Various types of lifting clamps have been devised, as for example, one of the applicant's has been granted a Patent No. 2,393,101 on a plate-lifting clamp, which, however, is only suitable for handling relatively thin stock such as steel plates. Lifting clamps of this type are entirely unsuited for the handling of steel billets and beams which have considerable thickness and which vary considerably in thickness. Adjustable lifting clamps have been used for handling brick, for example, and commonly include a lifting lever pivoted to a bar carrying a pair of jaws, one of which is moved by the lever when a lifting force is applied thereto. However, the structure of such devices is not such as to suit them for handling heavy loads of the order of one to three tons.

There is therefore a definite need for an adjustable lifting clamp in which the elements of the structure are designed and arranged to grip and lift heavy loads of substantially varying dimensions, such as various sizes of steel billets, castings and steel beams or other beams.

The primary object, therefore, of our invention is to provide a readily adjustable lifting clamp which is adapted to grip members of different dimensions and to lift them from either a horizontal, vertical or an intermediate position.

A further object of the invention is to provide an improved adjustable lifting device for handling loads of considerable weight such as from 1 to 3 tons, which is inexpensive to manufacture and which is safe in operation.

In accordance with the features of our invention the improved adjustable lifting clamp comprises a tension beam having a fixed jaw at one end, a slidable jaw mounted on the beam and movable therealong toward and away from the fixed jaw, means for resisting movement of the movable jaw away from the fixed jaw, a gripping cam mounted in the fixed jaw and adapted to engage the object to be lifted, a radius link pivoted in the beam adjacent the position of the fixed jaw, a connecting link between the radius link and the cam, said connecting link being pivoted to the cam intermediate its ends and to one end of the radius link, and a lifting linkage including portions connected respectively to the opposite end of the radius link and to the slidable jaw.

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The improved clamp advantageously includes a rack along the portion of the beam of the clamp facing in the direction of the jaws and a pawl on the slidable jaw adapted to engage the rack on the beam whereby the slidable jaw is held in a fixed position with respect to the fixed jaw. The slidable jaw also advantageously includes a spring engaging the side of the beam opposite the rack for insuring engagement of the pawl with the rack when the slidable jaw is moved toward the fixed jaw.

A handle is also advantageously provided on the end of the beam opposite the fixed jaw for setting the clamp in place particularly when it is desired to set the clamp on a horizontal or inclined object to be lifted.

An important feature of the improved adjustable clamp comprises an advantageous arrangement of the position of the connecting link between the cam and the end of the radius link extending toward the slidable jaw and the coupling of a lifting shackle of the lifting linkage to the outer end of the radius link, whereby it is possible to effect horizontal gripping and lifting in an unusually effective manner. For example, the adjustable lifting clamp may be set on the end of a horizontal or inclined billet and when lifting force is applied to the device to lift it, this particular arrangement insures a firm grip.

This function, as well as other features of the present invention are described in detail hereinafter along with an illustrative embodiment of the improved adjustable lifting clamp shown in the accompanying drawings which form a part of this application.

In the drawings:

Fig. 1 is an elevational view of an adjustable lifting clamp embodying the features of our invention shown in connection with the gripping and lifting of a steel billet from a substantially horizontal position.

Fig. 2 is a view of the lifting clamp shown in Fig. 1 illustrating the gripping and lifting of a steel billet from vertical position.

Fig. 3 is a broken elevational end view on a larger scale taken from the left in Fig. 2.

Fig. 4 is a view similar to that of Fig. 3 taken

from the right in Fig. 2, with the handle broken away.

Fig. 5 is a longitudinal vertical sectional view through the adjustable lifting clamp shown in Figs. 1 to 4, taken on the line 5—5 of Fig. 4.

Fig. 6 is a plan view of the clamp shown in Figs. 1 to 5, with parts of the lifting linkage shown in phantom.

Referring to Figs. 1 and 2 of the drawings, the improved adjustable lifting clamp shown therein and gripping a billet 9 comprises in general a tension beam 10 having a head 11 from which an integral fixed jaw 12 projects and a movable jaw 14 projecting in the same direction as the jaw 12 and slidable on the tension beam 10. A handle 15 is mounted on the end of the tension beam 10 opposite the head 11. The jaw 14 includes a serrated gripping pad 16 and a pawl 18 engaging in a rack 20 (Figs. 4 and 5). The fixed jaw 12 has pivoted therein a gripping cam 21 facing toward the jaw 14. A radius link 22 is pivoted in the head 11 of the clamp and its inner end is connected to cam 21 by a pair of connecting links 23.

Lifting and gripping is effected by applying a lifting force to the outer end of the radius link 22 and to the upper part of the slidable jaw 14 through a lifting linkage, as shown, for example, in Figs. 1 and 2, which includes a lifting shackle 24 pivoted to the radius link 22, a safety hook shackle link 25 hooked into an eye in the shackle 24, the upper end of the link 25 being coupled in an anchor shackle 26 adapted to be engaged by a lifting hook 27 carried on a cable or chain operated by a lifting crane or other hoisting device. A shackle 28 is pivoted to the upper part of the slidable jaw 14 by a pivot pin or rivet and this shackle is connected to the pin of the anchor shackle 26 by a closed link 29 mounted between the forked end of the link 25.

The tension beam head and fixed jaw of the clamp is advantageously constructed in the manner illustrated in Figs. 5 and 6, so that the fixed jaw 12 is integral with the beam of the clamp. A pair of L-shaped side plates 30 are mounted opposite each other in spaced relation on a bar 31 which is rectangular in cross-section and extends substantially the length of the beam 10. The rack 20 comprises a bar, as shown in Fig. 5, having the thickness of the bar 31 and mounted directly thereunder between the plates 30, the teeth, however, being slightly above the lower edges of the side plates 30. At the lower end of the jaw 12 the plates 30 are held in spaced relation, the same distance apart as the thickness of the bar 31 by a spacer block 32 welded to each of the plates, this block also serving as a stop for the front of the cam 21 which is mounted between the plates 30. The plates 30 are also held in fixed spaced relation by a spacer 32a riveted in position for stopping the back of the cam 21.

The sides plates 30 are held firmly together and clamped to the bar 31 and the rack 20 by means of countersunk rivets 33. The spacer bar 31 extends short of the right end of plates 30, thereby leaving an end space in which the handle 15 is mounted by means of a rivet or pin 34. The rack 20 and bar 31 extends substantially short of the inner face of the jaw 12 so as to permit free movement of the radius link 22 in the head 11 between the plates 30, within the angular range indicated in Fig. 5.

The slidable jaw 14 is advantageously made up of similar half sections which are cut out to fit the beam 10 and held together by rivets 35. The pawl block 18 is mounted in the lower portion of the channel through the jaw 14 with the pawl proper in back of the jaw, the block being held firmly in place by means of a rivet 36. A leaf spring 37 is mounted in the upper portion of the channel in the jaw 14 and is slidable on the top of the beam 10. This spring is held in place by a stop 38 which is welded in the upper portion of the channel. The spring serves to rock the jaw 14 counterclockwise, thereby insuring engagement of the pawl 18 in the notches of the rack 20 when the jaw is slid toward the fixed jaw 12.

The gripping pad 16 faces toward the jaw 12 and has a concentrically serrated face, the lower portion of the jaw 14 being provided with the bores, as shown, for receiving and mounting the pad and for providing a bore for driving out one pad and replacing it by a new one. The upper portion of the jaw 14 terminates in a lug 39 to which the shackle 28 is attached by means of a pin or rivet 40.

Referring to Fig. 5 of the drawings, the cam 21 mounted in the jaw 12 is provided with the usual cross-serrated gripping edge along its cam surface for gripping a billet or other object held between the jaws of the clamp. This cam 21 is provided with hub portions on (Fig. 3) each side so that it is mounted centrally between the plates 30 on a pivot pin 41. Between the pin 41 and the serrated cam surface a bore is provided for receiving a pivot pin 42 engaging the ends of the pair of connecting links 23, the pin 42 having a length about equal to the space between the plates 30, so that it is freely movable therebetween by operation of the connecting links 23 which extend on opposite sides of the cam. The radius link 22 is pivoted in the head 11 on a pin 41a like the pin 41.

The connecting links 23 also extend on opposite sides of the inner end of the radius link 22 and are pivoted thereto by a pin 43 similar to the pin 42. The lower end portion of the lifting shackle 24 is forked as shown in Figs. 3 and 6, so that it includes opposite portions extending on each side of the outer end of the radius link 22 and pivoted thereto by a pin 44 which is similar to the pin 42 and is operable between the plates 30. The pin 44 may press-fit one of the members or be retained in place by other suitable means.

The radius link 22 has hub portions on opposite sides which bear against the plates 30 and serve to center the radius link between these plates. These hub portions are of diamond shape, as shown in Fig. 5, which include opposite points 45 and 46 arranged at right angles to the axis of the link 22, that is, a line through the points 45 and 46 is at right angles to a line extending through the pins 43 and 44, as seen in Fig. 5. The pins 41, 41a and that in the shackle 26, may be held in place with cotter pins.

In the operation of the adjustable lifting clamp the handle 15 is particularly useful in engaging a billet resting in horizontal or inclined position, as shown in Fig. 1. It may also be used when the clamp is lowered to the position shown in Fig. 2. When it is desired to engage a billet or other object the slidable jaw 14 is moved to the right in Fig. 5 by application of pressure in that direction at the top of the jaw, thereby bending the spring 37 and rocking the jaw to disengage the pawl 18. The jaw 14 is then slid to the right as far as necessary and the clamp set over the object to be lifted, it being understood, of course, that the lifting linkage is slack.

At this point the lifting shackle 24 is moved down to bring the cam 21 fully within the jaw 12, as shown, as in the full line showing in Fig. 5, with the cam resting against the stop 32a. The slidable jaw 14 is then moved toward the fixed jaw 12 until both jaws engage the object to be lifted and the pawl 18 is engaged in the rack 20. Thereupon lifting force is applied to the anchor shackle 26 and as tension is applied to the lifting shackle 24, the radius link 22 is rotated clockwise (Fig. 5) to move the gripping edge of the cam 21 firmly into engagement with the object to be lifted. This results in applying an enormous gripping pressure between the jaws of the clamp and a strong tension to the tension beam 10. The gripping action of the cam 21 and the pad 16 are sufficient to hold any weight for which the clamp is made, so that the object being lifted may be safely moved to its desired position.

In setting the clamp onto the end of a horizontal beam or billet 9, such as shown in Fig. 1, the weight of the clamp is lifted by the handle 15, while at the same time pushing down on the lower portion of the slidable jaw 14 until the fixed jaw is brought into engagement with the lower portion of the billet 9. At this point, as shown in Fig. 1, the main lifting force will be on the lifting shackle 24 until the object is in upright position (Fig. 2) when the other part of the linkage attached to the jaw 14 will carry its share of the weight.

It will be noted in Fig. 5 that the lifting shackle 24 is provided with an indentation 47 which is engaged by the projection 46 on the hub of the radius link 22 and serves as a bearing for the application of leverage to the radius link to force the cam 21 into firm engagement with the object to be lifted in the manner shown in Figs. 1 and 5. Leverage is applied in most cases until the head 48 rests on the link 25 as when the linkage assumes the position shown in Fig. 2. The opposite points 45 on the radius link make it symmetrical for assembly purposes.

When the clamp is gripping an object and the jaws are spread relatively far apart as in Figs. 1 and 5, it will be seen that the line of pull of the link 25 will apply considerable pressure to the point 46 and gripping leverage on the radius link. The connection of the lifting shackle 24 to the outer end of the radius link therefore gives an important function in lifting objects from horizontal or inclined positions, since the pull on the link 24 is at an inclined angle to the link 25. Links 24 and 25 are always at an inclined angle to the tension beam 10 and the inner face of the fixed jaw 12. This arrangement results in the application of an adequate and safe pressure on the cam 21 which could not otherwise be obtained, and it also makes it possible to lift objects from a horizontal or inclined position such as that shown in Fig. 1.

After an object has been moved to its desired location and the lifting linkage slackened, the cam 21 may be quite firmly gripped to the object, particularly if, in the gripping action, the pivot pin 42 should go as low as a point opposite the pin 41. In such a case the cam may be readily unlocked by hitting the head 48 of the lifting shackle 24 with a hammer. The striking of the head 48 with a hammer acts to rotate the member 22 on its pivot 41a and thereby lift the cam 21 with the links 23 which are pivoted to the opposite end of the member 22 from that of the member 24 carrying the head 48. The stop 32a is located so that the cam 21 is movable completely inside the jaw 12 and so that the pin 42 cannot be brought in line with the pins 41 and 43. Clockwise rotation of the radius link 22, therefore, always has adequate leverage for moving the cam forward.

The hook 25 is made in the form of a safety hook engaging an eye in the shackle 24, the end of the hook being flattened out as at 49, as shown in Fig. 3, so that the hook cannot be run back through the eye.

In the preferred form of construction the tension beam 10 and the fixed jaw 12 are preferably constructed in the manner shown in the drawings and described above. It is also preferred to make the slidable jaw 14 in two pieces as described, and assemble them together face to face. However, the invention is not limited to making the tension beam and jaw 14 in this particular manner since they may be made of single pieces of suitable steel or built up from structural steel elements in different ways. The slidable jaw 14, for example, may include two side plates riveted to upper and lower spacer blocks.

What we claim is:

1. An adjustable lifting clamp comprising a tension beam having a head including a fixed clamping jaw extending from one side of the beam, said tension beam comprising a pair of similar steel side plates mounted face to face in spaced relation, a spacer bar mounted between said plates from substantially the head of the beam to the opposite end of the beam thereby providing a space between the portions of the plates forming the head of the clamp and jaw, means for securing said plates and bar in a compact rigid assembly, a slidable jaw mounted on said beam facing said fixed jaw, means for retaining said slidable jaw in position along said beam, a cam pivoted between the plates in the lower portion of the fixed jaw and adapted to be rotated toward the slidable jaw in a lifting operation, leverage means mounted between the plates in said head including a radius link pivoted in the upper portion of the head and extending generally in the direction of the beam, a pair of compression connecting links arranged in parallel with one end of the pair of links pivoted to the inner end of the radius link, the other end of the pair of connecting links being pivoted to the cam inwardly from its pivot point with respect to the plates forming the jaw, and a forked lifting linkage one leg of which is pivotally connected to the slidable jaw and the other leg of which is pivotally connected to the outer end of the radius link, whereby the application of a force to the outer end of the radius link applies pressure through the radius link to said pair of connecting links to force the cam toward the slidable jaw of the lifting clamp.

2. An adjustable lifting clamp for gripping and lifting loads of substantially varying dimensions, comprising a tension beam having a head including a fixed clamping jaw projecting from one side of the beam, a jaw slidably-mounted on said beam projecting therefrom and facing said fixed jaw, means for retaining said slidable jaw in a selected position along said beam, a cam pivoted in the lower portion of the fixed jaw and adapted to be rotated toward the slidable jaw in a lifting operation, said cam having a gripping cam surface facing toward the slidable jaw, leverage means mounted in said head including a radius link pivoted in the upper portion of the head and normally extending generally in the direction of the beam, a pair of compression connecting links arranged in parallel, one end of said pair of links

being pivoted to the end of the radius link nearest to the slidable jaw, the other end of the pair of connecting links being pivoted to the cam inwardly from its pivot point with respect to the fixed jaw, and a forked lifting linkage one leg of which is pivotally connected to the slidable jaw and the other leg of which is pivotally connected to the outer end of the radius link, whereby the application of a force to the outer end of the radius link applies pressure throuugh the radius link to said pair of connecting links to force the cam toward the slidable jaw of the lifting clamp.

3. An adjustable lifting clamp for gripping and lifting loads of substantially varying dimensions, comprising a tension beam having a head including a fixed clamping jaw projecting from one side of the beam, a movable jaw including means slidably-mounted on said beam, said movable jaw projecting in the same direction as and facing the fixed jaw, means for retaining said slidable jaw in a selected position along said beam, a gripping cam pivoted in the lower portion of the fixed jaw and adapted to be rocked on its pivot toward the slidable jaw in a gripping and lifting operation, leverage means mounted in said head including a radius link pivoted at its center in the upper portion of the head and normally extending generally in the direction of the beam, a compression connecting link one end of which is pivoted to one end of the radius link, the other end of said connecting link being pivoted to the cam inwardly from its pivot point in the fixed jaw, and a forked lifting linkage one leg of which is pivotally connected to the slidably mounted means carrying the movable jaw on the side of the beam opposite the movable jaw, the other leg of the lifting linkage being pivotally connected to the other end of the radius link, whereby the application of a force to the last-mentioned end of the radius link by the lifting linkage applies pressure through the radius link to said connecting link to force the gripping cam toward the movable jaw of the lifting clamp.

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