July 26, 1966 R. L. RENFROE 3,262,731

LOCKING CLAMP

Filed Dec. 10, 1964

FIG. 3

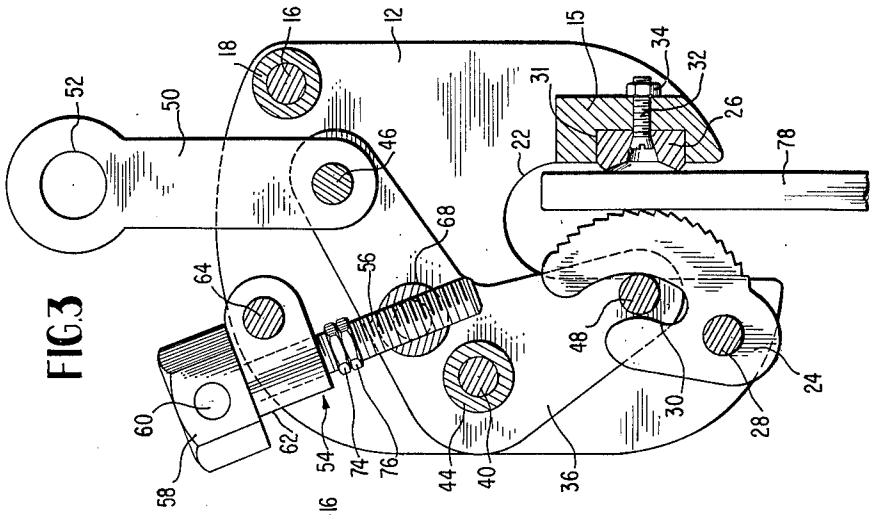


FIG. 2

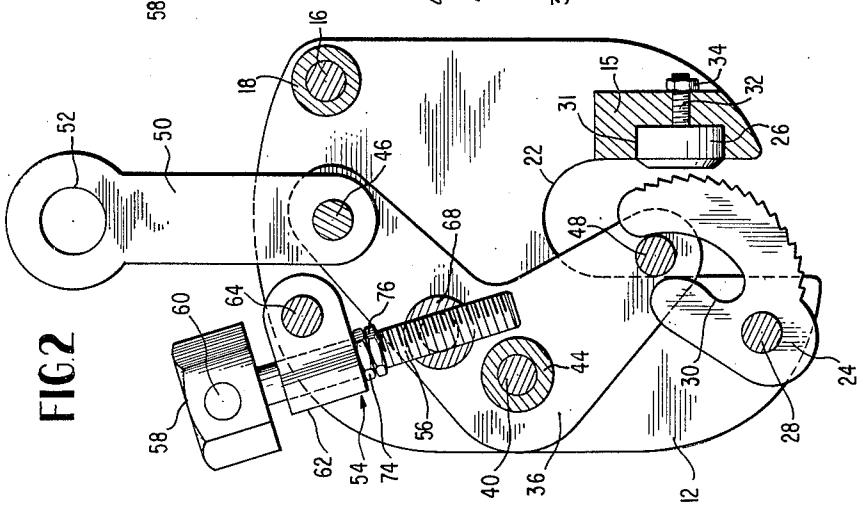
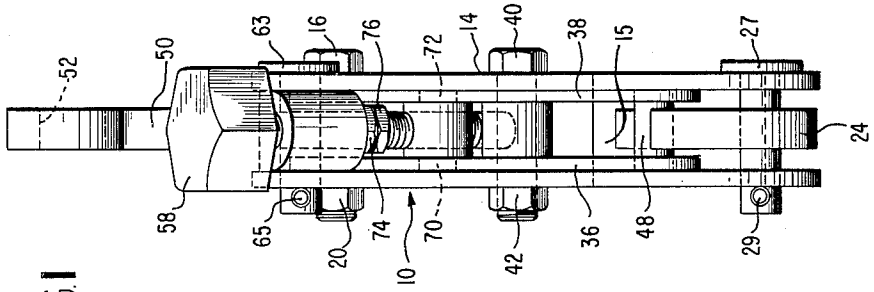


FIG. 1



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LOCKING CLAMP

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8 Claims. (Cl. 294—101)

This is a continuation-in-part of application Serial No. 307,415 filed Sept. 6, 1963, now U.S. Patent No. 3,167,343.

This invention relates to clamps for lifting structural articles and more particularly to lifting clamps which include improved locking means for securing the clamp to the structural article. My previous invention relates to a lifting clamp having a locking means which provides an adjustable lock to positively prevent retraction of the jaws from a gripping relation and which includes resilient means to compensate for any slack created in the locking means. The present invention is directed to a lifting clamp having an adjustable lock feature without the resilient means and to the combination of the adjustable lock with a lifting clamp having a bell crank type linkage.

It has been previously suggested in the art to positively lock the pivotable jaw of a clamp by the use of a bolt which abuts the backside of a jaw and urges it into gripping relation. Because of the pivotal motion of such jaws, these bolts have been designed to abut on a cam surface on the back of the jaw and have not been fastened to the jaw or to the linkage means connected to the jaw. While this arrangement has served to hold the jaw in gripping relation, it has encountered certain disadvantages. In the first place, the jaw must have a cam surface machined in the side which is abutted by the bolt. Even when the rear surface of the jaw is properly cammed, there is binding between the jaw and the bolt which makes it difficult to withdraw the bolt from the jaw when it is desired to open the jaws of the clamp. A further disadvantage lies in the fact that the withdrawal of the bolt will not withdraw the jaw from the gripping relation but merely will allow the jaw to move backwards. Additionally, since the bolt must act directly on the jaw, advantage cannot be taken of distance multiplying means to reduce the distance which the bolt must move in locking the jaw; thus, the prior art bolts have projected substantial distances away from the body of the clamp and, being located in the vicinity of the jaws, the bolts interfere with the use of the clamp.

It is, therefore, an object of this invention to provide an improved locking means to positively secure clamp jaws in a gripping position upon the structural article to be lifted.

Another object of this invention is to provide a lifting clamp with an improved locking means which may act through the clamp linkage to positively secure the jaws in a gripping relation.

Still another object of this invention is to provide a locking means for a lifting clamp which positively secures the jaws in a gripping relation and which may be used to withdraw the jaws from the gripping relation.

A further object of this invention is to provide a locking means for a lifting clamp which positively secures the jaws in a gripping relation and is located in a position remote from the jaws of the clamp.

A still further object of this invention is to provide a locking means for a lifting clamp which is easy to operate by manual manipulation and which is simple in construction so that the cost of construction and maintenance thereof is substantially reduced.

The invention relates generally to a clamp for lifting structural articles which comprises a clamp body, a pair of opposed jaws mounted on said clamp body and defining a slot between the jaws to receive the article to be lifted, one of said jaws being movable with respect to said

other jaw, linkage means connected to said clamp body to bring said jaws to a gripping relation relative to the article as a lifting force is applied to the clamp, said linkage means including a shackle to which the lifting force may be applied; and adjustable lock means to prevent the retraction of said jaws outwardly away from the gripping relation, said adjustable lock means including a first member attached to said clamp body, a second member attached to said linkage means, a threaded rod extending through said members, said rod being threadably connected to one of said members, and freely slidable relative to the other member, and stop means affixed to said rod and movable axially therewith into engagement with said other member as said rod is rotated to move said rod in a locking direction so that further rotation of said rod applies a positive locking force to said movable jaw.

Preferably, the locking means includes a second stop means affixed to said rod and movable axially therewith into engagement with said other member as said rod is rotated to move said rod in an unlocking direction so that rotation of said rod applies a positive opening force to said movable jaw.

It is also preferred that said linkage include a bell crank lever, first pivot means pivotally connecting said bell crank lever to said clamp body near the mid point of said bell crank lever, second pivot means pivotally connecting said bell crank lever to said shackle near the upper end of said bell crank lever, and means slidably connecting said bell crank lever to said movable jaw near the lower end of said bell crank lever.

Desirably, said second member is attached to said bell crank lever at a point between said first and said second pivot means, said first member is located above said second member, said first stop means is located above said first member, and said second stop means is located between said first and said second members.

The invention having been generally described a preferred specific embodiment will now be set forth in detail with reference to the accompanying drawing in which:

FIGURE 1 is an end elevation of a clamp constructed in accordance with the teachings of this invention.

FIGURE 2 is a side elevation partially in section of the clamp of FIGURE 1 showing the lock in the opened position.

FIGURE 3 is a side elevation partially in section of the clamp of FIGURE 1 showing the lock in the closed position.

The clamp structure includes a body, generally **10**, comprised of two side plates **12** and **14** spaced apart by a center block **15** rigidly secured to the inside of each of plates **12** and **14** and a spacer sleeve **18** mounted on a bolt **16** extending through openings in plates **12** and **14**. A nut **20** on bolt **16** holds plates **12** and **14** against spacer sleeve **18**.

The lower end of each of plates **12** and **14** contains a slot **22** for receiving the article to be lifted. A pair of opposed jaws **24** and **26** are mounted on opposite sides of slot **22**. Cam jaw **24** having a serrated gripping edge is pivotally mounted on a camp pin **28** extending through plates **12** and **14**. Jaw **24** contains a cam slot **30** in the upper end thereof for pivoting the jaw about cam pin **28** toward or away from jaw **26**. Cam pin **28** is held in position on plates **12** and **14** by a head **27** and a locking pin **29**. Swivel jaw **26** is mounted in a recess **31** in center block **15** by a bolt **32** and nut **34** which allows jaw **26** to rotate about the longitudinal axis of bolt **32**.

A pair of aligned bell crank links **36** and **38** are pivotally mounted in body **10** near their mid points by a bolt **40** passing through plates **12** and **14** and held in position by a nut **42**. (Side plate **14** and link **38** have been omitted from FIGURES 2 and 3 so that the remaining parts of the clamp may be more easily viewed.) Bell crank links

36 and 38 are spaced apart by a spacer sleeve 44 mounted on bolt 40 and extending between the two links. A shackle pin 46 is mounted between the upper ends of links 36 and 38 and a floating cam pin 48 is mounted between their lower ends. A lifting shackle 50 is pivotally mounted between links 36 and 38 on shackle pin 46 and extends upwardly out of the body 10 of the clamp. Shackle 50 has an eye 52 in its upper end for connecting the clamp to a lifting grapple or the like. Jaw 24 extends to between the lower ends of links 36 and 38 with cam pin 48 being slidably received in cam slot 30.

A locking assembly generally 54 is mounted in the upper end of clamp body 10. The locking assembly operates through a bolt 56 having a head 58 on its upper end. Head 58 has a hole 60 on one side thereof for receiving a bar which may be used to assist in turning the bolt. An abutment means 62 is pivotally mounted between side plates 12 and 14 by a pin 64 extending through side plates 12 and 14 and being held in position by a head 63 on one end and a locking pin 65 on the other end.

A connecting means 68, which comprises a cylindrical cross member, is pivotally mounted between links 36 and 38 by pins 70 and 72, respectively. Both abutment means 62 and connecting means 68 have openings extending therethrough for receiving bolt 56. Connecting means 68 is internally threaded to threadably receive bolt 56. A pair of nuts 74 and 76 are mounted on bolt 56 between abutment means 62 and connecting means 68. Nuts 74 and 76 are threaded in opposite directions so that they can be placed on bolt 56 at a desired position and locked in position by turning them tightly together.

In the use of the clamp, locking assembly 54 is set in the open position as illustrated in FIGURE 2. The object to be lifted 78 is inserted in slot 22 between jaws 24 and 26 with the jaws in open position. The jaws are normally opened by the application of a downward force on the shackle 50. This force causes bell crank links 36 and 38 to pivot clockwise about bolt 40 drawing bolt 56 downwardly until head 58 contacts abutment means 62. If the opening between jaws 24 and 26 is insufficient, bolt 56 may be screwed further out of connecting means 68 until nut 74 contacts abutment means 62. Continued turning of bolt 56 pivots links 36 and 38 clockwise. This clockwise movement of the links causes floating cam pin 48 to move downwardly in slot 30 of jaw 24 and further retract jaw 24 out of slot 22.

After the object is located in slot 22 between jaws 24 and 26, bolt 56 is screwed downwardly until head 58 contacts abutment means 62, as illustrated in FIGURE 3. Further turning of bolt 56 will cause connecting means 68 to rise up the threads on bolt 56 and pivot links 36 and 38 counter-clockwise about bolt 40. This movement of the links causes floating cam pin 48 to move upwardly in slot 30 and inwardly relative to slot 22. Thus the pin 48 urges jaw 24 firmly against object 78. By using a wrench on head 58 or by placing a rod in hole 60, leverage may be gained on bolt 56 to firmly urge jaw 24 against object 78 and thus lock the jaws of the clamp firmly on the object.

The clamp, with the object secured therein, may be lifted by a cable hoist or other lifting means connected to eye 52 in shackle 50. The lifting force acts through the shackle and bell crank linkage to further urge jaw 24 against the object. Locking assembly 56 does not interfere with this additional gripping force since any further counter-clockwise movement of bell crank links 36 and 38 slides head 58 upwardly away from abutment means 62.

When it is desired to set object 78 down, the clamp may be lowered until the object hits a firm surface. To release object 78 from the clamp, bolt 56 is rotated in a direction which tends to withdraw it from connecting means 68 until nut 74 contacts abutment 62. Further turning of bolt 56 causes connecting means 68, which is

threadably received on bolt 56, to move downwardly along bolt 56. This movement pivots bell crank links 36 and 38 clockwise about bolt 40 and causes floating cam pin 48 to move downwardly in slot 30 and outwardly relative to slot 22. Such movement of pin 48 retracts jaw 24 and releases object 78.

With connecting means 68 being mounted adjacent bolt 40, the movement of bolt 56 into or out of the clamp body 10 is small compared to the movement of jaw 24 toward or away from jaw 26. Thus at no time does bolt 56 project very far out of clamp body 10. Since locking assembly 54 is mounted at a position in the upper portion of the clamp body 10 remote from the jaws and only the upper end of the relatively upright bolt 56 extends out of the clamp body, the locking assembly in no way interferes with the use of the clamp.

It will be obvious to those skilled in the art that another pair of nuts similar to nuts 74 and 76 could be mounted on the end of bolt 56 below connecting means 68 and that abutment 62 may be threaded with bolt 54 being slidably mounted in connecting means 68. This modification would operate similarly to the preferred embodiment described above. To lock the jaws, bolt 56 is screwed outwardly of abutment 62 until the nut on the end of bolt 56 contacts connecting means 68. Further turning of bolt 56 rotates links 36 and 38 counterclockwise and urges jaw 24 toward jaw 26. To open the jaws, bolt 56 is screwed inwardly of abutment 62 until nut 76 contacts connecting means 68. Further turning of bolt 56 rotates links 36 and 38 clockwise and withdraws jaw 24 away from jaw 26.

The drawing and the above description illustrate what is considered to be a preferred embodiment of the invention. Other modifications and variations of this invention will become readily apparent to persons skilled in the art without departing from the scope of the invention which is defined fully by the appended claims.

I claim:

1. A clamp for lifting structural articles comprising:
a clamp body;
a pair of opposed jaws mounted on said clamp body and defining a slot to receive the article to be lifted, one of said jaws being movable with respect to said other jaw;
linkage means connected to said clamp body to bring said jaws to a gripping relation relative to the article as a lifting force is applied to the clamp, said linkage means including a shackle to which the lifting force may be applied; and
adjustable lock means to prevent the retraction of said jaws outwardly away from the gripping relation, said adjustable lock means including a first member attached to said clamp body, a second member attached to said linkage means, a threaded rod extending through said members, said rod being threadably connected to one of said members and freely slidable relative to the other member, and stop means affixed to said rod and movable axially therewith into engagement with said other member as said rod is rotated to move said rod in a locking direction so that further rotation of said rod applies a positive locking force to said movable jaws, said rod being free of any bias opposing said movement of said stop means into engagement with said other member.

2. The clamp of claim 1 wherein the locking means includes a second stop means affixed to said rod and movable axially therewith into engagement with said other member as said rod is rotated to move with said rod in an unlocking direction whereby rotation of said rod applies a positive opening force to said movable jaw.

3. The clamp of claim 1 wherein said linkage includes a bell crank lever, a first pivot means pivotally connecting said bell crank lever to said body near the mid point of said bell crank lever, a second pivot means pivotally connecting said bell crank lever to said shackle near the upper end of said bell crank lever, and means slidably

connecting said bell crank lever to said movable jaw near the lower end of said bell crank lever.

4. The clamp of claim 3 wherein said second member is attached to said bell crank lever at a point between said first and said second pivot means, said first member is located above said second member, and said stop means is located above said first member.

5. The clamp of claim 4 wherein said second member is adjacent said first pivot means.

6. A clamp for lifting structural articles comprising:

a clamp body;

a pair of opposed jaws mounted on said clamp body and defining a slot to receive the article to be lifted, one of said jaws being movable with respect to said other jaw;

linkage means connected to said clamp body to bring said jaws to a gripping relation relative to the article as a lifting force is applied to the clamp, said linkage means including a shackle to which the lifting force may be applied, a bell crank lever, a first pivot means pivotally connecting said bell crank lever to said body near the mid point of said bell crank lever, a second pivot means pivotally connecting said bell crank lever to said shackle near the upper end of said bell crank lever, and means slidably connecting said bell crank lever to said movable jaw near the lower end of said bell crank lever;

and adjustable lock means to prevent the retraction of said jaws outwardly away from the gripping relation, said adjustable lock means including a first member pivotally attached to said clamp body, a second member pivotally attached to said linkage means, a threaded rod extending through said members, said

rod being threadably connected to one of said members and freely slidable relative to the other member, first stop means fixed to said rod and movable axially therewith into engagement with said other member as said rod is rotated to move said rod in a locking direction so that further rotation of said rod applies a positive locking force to said movable jaw, and a second stop means fixed to said rod and movable axially therewith into engagement with said other member as said rod is rotated to move with said rod in an unlocking direction whereby rotation of said rod applies a positive opening force to said movable jaw.

7. The clamp of claim 6 wherein said rod is threadably connected to said second member, said second member is attached to said bell crank lever at a point between said first and second pivot means, said first member is located above said second member, said first stop means is located above said first member, and said second stop means is located between said first and said second members.

8. The clamp of claim 7 wherein said second member is adjacent said first pivot means.

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