April 24, 1962 L. STEWART 3,031,222

LIFTING DEVICE

Filed Jan. 18, 1961 2 Sheets-Sheet 1

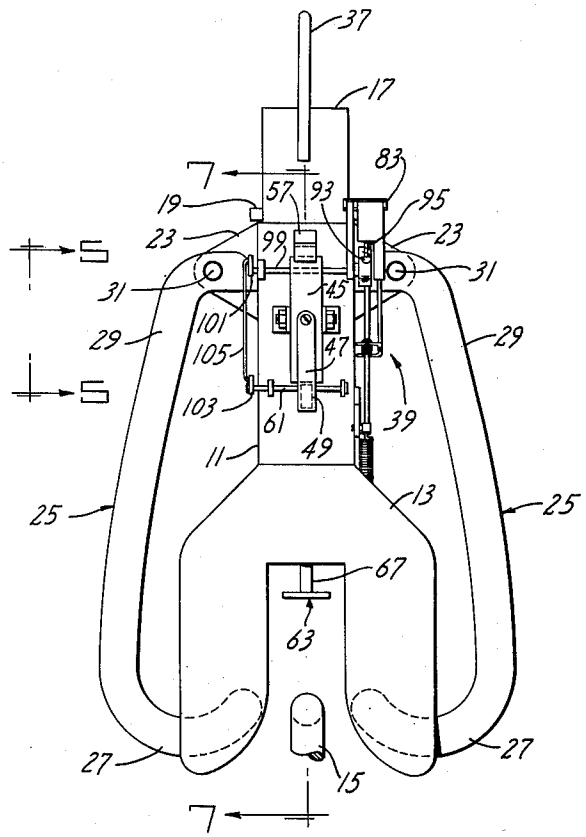


FIG_1.

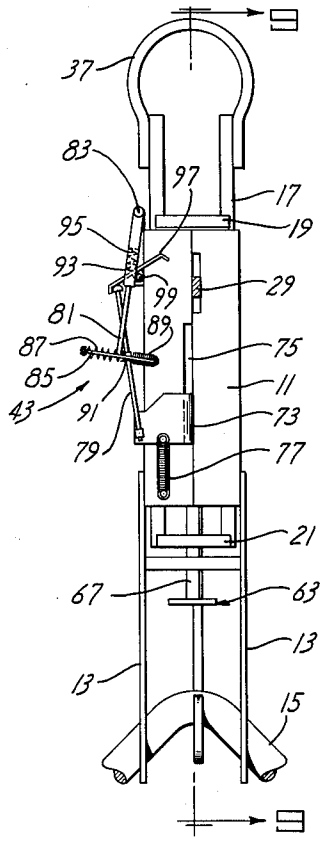


FIG_2.

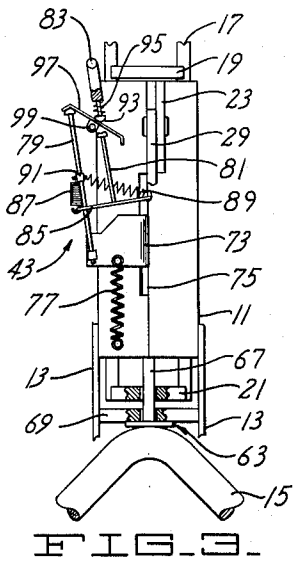


FIG_3.

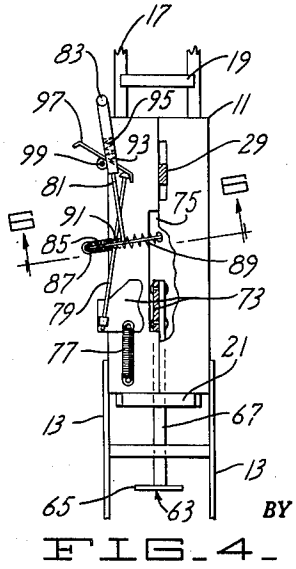


FIG_4.

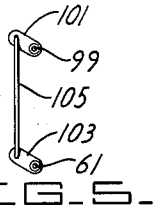


FIG_5.

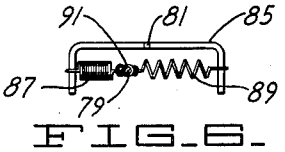


FIG_6.

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LIFTING DEVICE

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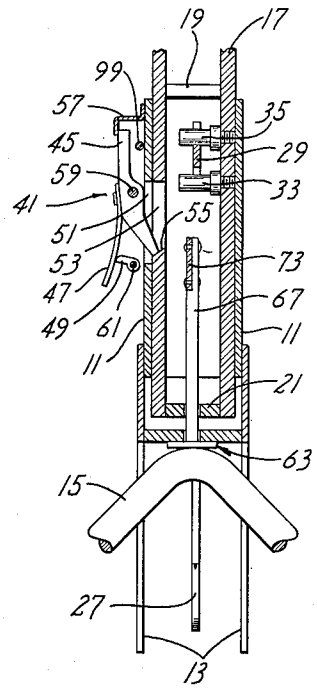


FIG_7_

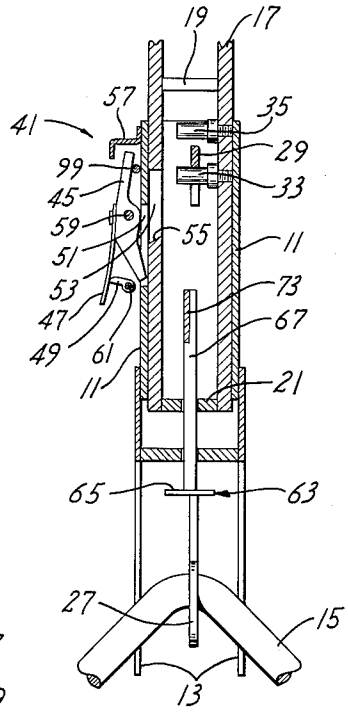


FIG_8_

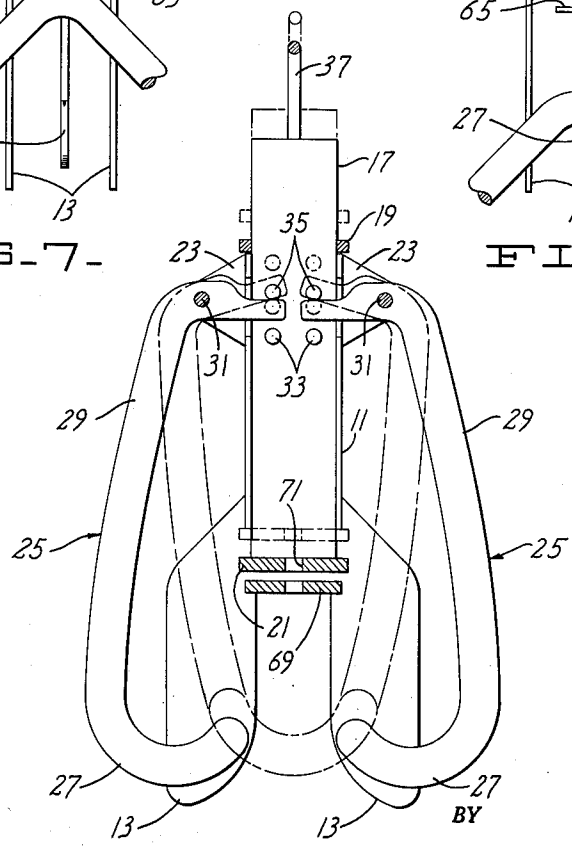


FIG_9_

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United States Patent Office 3,031,222 Patented Apr. 24, 1962

3,031,222

LIFTING DEVICE

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Filed Jan. 18, 1961, Ser. No. 83,531
1 Claim. (Cl. 294—110)

This invention relates to lifting devices, and more particularly to such lifting devices as are used in the construction industry, as for instance, in lifting concrete buckets.

On heavy construction projects, it is often necessary to transport large amounts of concrete by means of buckets. Generally the buckets are filled from trucks or from a central plant, and a number of the same brought near the site to be moved by crane or other conveying means to the particular location at which the concrete is to be used.

Generally an operator stands on the bucket and places a hook over its handle or securing means. Subsequently, the bucket is moved to the location, unloaded, and returned to the operator who unhooks the empty bucket and applies the hook to the next filled bucket. It is apparent that not only is operator time required but also, due to the heavy equipment involved, a personal hazard is created.

Various means have been developed in the past for alleviating the problem of operator time and safety hazard. However, no device has yet been produced which will entirely do away with the operator, eliminate the safety hazard, and at the same time provide fault free operation.

It is, therefore, a general object of this invention to provide an improvement in lifting devices.

It is a more particular object of this invention to provide a lifting device which is capable of automatically lifting and releasing a bucket or similar device.

It is another object of this invention to provide a lifting device of the above mentioned character, employing a mechanical bistable switching element, whereby upon the first activation the lifting device is positioned to lift a bucket held thereby and in the second activation of the bistable element the lifting device is positioned to release said bucket.

It is still another object of this invention to provide a lifting device of the aforementioned character wherein said bistable element is activated entirely by positioning said lifting device onto the bucket or similar device.

It is another object of this invention to provide a lifting device of the aforementioned character wherein no external power source is needed to activate the bistable device from one of its stable states to the other.

These and other objects and features of the invention will become more clearly apparent upon a review of the following description in conjunction with the accompanying drawing in which:

FIGURE 1 is a front elevational view of a lifting device in accordance with this invention;

FIGURE 2 is a side elevational view of the device shown in FIGURE 1;

FIGURE 3 is a partial side elevational view showing the bistable device in position wherein the hook means may be urged open;

FIGURE 4 is a partial side elevational view of the device shown in FIGURE 1 wherein the bistable device is in one of its stable conditions with the hooks closed;

FIGURE 5 is an elevational view from the opposite side taken along the lines 5—5 of FIGURE 1 and showing the link arrangement for urging the latch means out of position;

FIGURE 6 is a view taken along the lines 6—6 of FIGURE 4;

FIGURE 7 is a section view taken along the lines 7—7 of FIGURE 1 and having the plunger in its separately urged position;

FIGURE 8 is likewise a section view taken along the lines 7—7 of FIGURE 1 but with the plunger in its lower position and with the hooks in their closed position; and

FIGURE 9 is a section view taken along the lines 9—9 of FIGURE 2.

Referring to FIGURES 1 and 2 the lifting device comprises an outer box-like housing 11 having a pair of spaced guide plates 13 secured thereon. The guide plates open outwardly somewhat in the shape of an inverted V and serve to guide the lifting device onto a handle or other similar means 15. An inner housing or carriage 17 is slidably disposed within the outer housing 11. An upper stop 19 is secured to the carriage 17 to limit the downward motion thereof. Similarly, a lower stop 21 secured to the carriage 17 limits the upward movement thereof. Each of the stops 19 and 21 abuts the outer carriage 11 to provide the motion limits.

A pair of outwardly extending ears 23 are secured to the outer housing 11. Arm 25 having lower hook portions 27 and upper portions 29 arranged in the form of bell cranks are pivoted to the ears 23 at the points 31.

As seen more particularly in FIGURE 8 inwardly extending arms of the bell crank portions 29 pass through the outer housing 11 and cooperates with lower and upper lugs 33 and 35, respectively, mounted on the carriage 17. As is apparent on viewing FIGURE 9, upon lowering the carriage 17 with respect to the outer housing 11, the inwardly extending arms of the crank portions 29 are urged downwardly and the hook portion 27 urged outwardly whereby the openings in the guide plates 13 are unobstructed and a handle 15 may be passed through. Conversely, when the carriage 17 along with the lugs 33 and 35 is raised with respect to the outer housing 11 the hooks 27 are urged inwardly whereby the handle is engaged by the hook portions 27.

Thus, it is seen that sliding movement of the carriage 17 in the housing 11 serves to open and close the hooks 27 and to alternatively permit passage of the handle and retention of the same.

It is apparent that merely lifting the carriage 17, for instance by means of a ring 37, will cause the hooks 27 to be closed by the mere weight of the outer housing 11. Thus, the natural tendency of the device thus far described is to close the hooks 27 when it is lifted by means of the carriage 17 and to close the hooks when the carriage and outer housing are telescoped together.

Means, however, are provided in accordance with this invention for preventing the hooks 27 to close and open upon sequential lifting and lowering the device by means of the carriage 17. To this end, a bistable element designated generally in the figures by the numeral 39 is included. The bistable element includes a latch portion 41, shown particularly in FIGURES 7 and 8, and a toggle portion 43 shown more particularly in FIGURES 2 to 6.

The latch portion 41 includes a latch 45 pivotally mounted on the outer housing 11. A leaf spring 47 is secured to the latch 45 and cooperates with a cam 49 to selectively urge the latch in a clockwise direction as shown in FIGURES 7 and 8. The outer housing 11 includes an opening 51 through which the latch 45 may pass freely. An opening 53 is included in the carriage portion 17. The lower portion of the opening 53 includes a stop 55 which is engaged by the latch 45 to prevent upward motion of the carriage 17 relative to the outer housing 11. A latch limit stop 57 is included on the outer housing 11 to prevent

the latch from passing completely through the opening 53. Thus, in its limited position as shown in FIGURE 7 the front edge of the latch 45 is placed in registry with the stop 55.

When the cam 49 is in the position shown in FIGURES 7 and 8 it is apparent that the latch 45 is urged in a clockwise direction about its pivot point 59. As will be described hereinafter the actual clockwise excursion of the latch may be further limited by frictional engagement with the stop 55. However, if the cam 49 is rotated through an angle of about 90° with its shaft 61 the latch arm 45 is free to rotate in the counterclockwise direction until limited by the stop 57 and engaged with the stop 55. This counterclockwise rotation of the latch 45 may be accomplished by gravity alone as in the embodiment shown. Alternatively, either spring means or direct cam means may be included to provide more positive engagement with the stop 55.

With the latch 45 in its clockwise position as shown in FIGURE 8, the carriage 17 is free to slide vertically within the outer housing 11. On the other hand, with the latch 45 in the counterclockwise position as shown in FIGURE 7 the carriage 17 is locked in its downward position with respect to the outer housing 11. As seen in FIGURE 9 the downward position of the carriage 17 along with the lugs 33 and 35 cause the hooks 27 to be extended outwardly as shown in solid lines.

Thus, there are two distinct conditions of the device which may be accomplished when the carriage unit 17 is raised. There is the natural closed position of the hooks 27 as shown in the dot-dash lines of FIGURE 9 and as previously described; and secondly there is the position as shown by the solid lines in FIGURE 9 which is brought about by engagement of the latch 45 as shown in FIGURE 7.

In order to provide alternate positions of the latch means, that is in its engaged and non-engaged positions, the toggle portion 43 of the bistable element is provided.

The toggle portion 43 includes a plunger 63 which includes a contact 65 secured to an upwardly extending shaft 67. The shaft 67 passes through a guide 69 which is affixed between the guide plates 13 and an opening 71 in the lower stop 21 of the carriage 17. An extension 73 is secured to the upper end of the shaft 67 and extends outwardly through the opening 75 of the outer housing 11. Guide means additional to the openings in the members 21 and 69 are not shown but may be provided to assure ease of vertical movement for the extension 73.

A tension spring 77 having one end secured to the outer housing 11 is utilized to urge the extension 73 into the downward position. Thus, the plunger 63, as well as the extension 73, has a normal position limited by the lower end of the opening 75. A link 79 is pivoted on the extension 73. Another link 81 is pivoted at a point 83 on the outer housing 11. The link 81 includes a straight portion terminating in transverse member 85 at the lower end thereof. The transverse member 85 is in the shape of a U (FIGURE 6) and is secured to the link 81 at approximately right angles thereto. Springs 87 and 89 each have one end secured at opposite extremities of the transverse member 85 and the other end of each of the springs 87 and 89 is secured to the link 79 by a collar 91.

The link 81 also includes a plunger 93 which is resiliently urged downward by means of a spring 95 onto a butterfly member 97. The butterfly member 97 is secured to a shaft 99 which is rotatably mounted on the outer housing 11 (FIGURE 1) and is terminated in a crank 101 (FIGURES 1 and 5). The crank 101 is connected to a similar crank 103 for simultaneous rotation therewith by means of a link 105. The crank 103 is secured to the shaft 61 upon which the cam 49 is affixed for selective engagement with the leaf spring 47. Thus, it is seen that the cam 49 is positioned as shown in FIGURES 7 and 8 and at an angle approximately 90° to this position by rotating the butterfly 97 from the position shown in FIGURES 3 and 4 to the position shown in FIGURE 2.

The structure of the particular embodiment having been described, the operation of the lifting device is as follows. It is assumed that initially the lifting device is in the stable condition shown in FIGURES 1 and 2 wherein the hooks 27 are in an open position and the toggle device 43 is in the position as shown in FIGURE 2. In this position of the toggle the cam 49 is located at a position approximately 90° clockwise from that shown in FIGURES 7 and 8 whereby the leaf spring 47 is relaxed and the latch arm 45 itself is in the position as shown in FIGURE 7 whereby its end is in contact with the stop 55. Thus, the carriage 17 is locked in its downward position and the hooks 27 are locked in their open position.

It should be remembered that during the entire operation the lifting device is suspended by the ring 37 from a crane, hoist or other device. Upon lowering the lifting device onto a handle 15 as shown in FIGURE 3 the plunger 63 is contacted thereby urging it upwardly against the tension of the spring 77. The upward extension of the plunger 63 relative to the outer housing 11 causes the link 79 to likewise be urged upward. Thus, the butterfly member 97 is rotated from the position shown in FIGURE 2 to that shown in FIGURE 3. This rotation, through the linkage shown in FIGURE 5, causes the cam member 49 to be rotated into the position shown in FIGURES 7 and 8 thereby applying tension to the leaf spring 47 with a consequent tendency to urge the latch arm 45 in a clockwise direction out of engagement with the stop 55. However, since the latch arm carries the weight of the outer housing 11 and the guide plates 13 there is a relatively high frictional engagement between the end of the latch member 45 and the stop 55. Therefore, even though the leaf spring 47 creates a tendency to rotate the latch 45 clockwise, this tendency is overcome by the frictional engagement of latch arm with the stop 55.

Upon further lowering of the lifting means onto the handle 15 the outer housing 11, as well as the plunger 63, is urged upward relative to the carriage. This relative movement of the outer housing 11 and the carriage 17 relieves the frictional engagement between the latch 45 and the stop 55 and permits the leaf spring 47 to urge the latch 45 clockwise out of engagement with the stop 55. With the latch 45 thus disengaged, as shown for instance in FIGURE 8, the carriage 17 is free to be moved upward relative to the outer housing 11. On subsequently raising the lifting device by means of the ring 37 the carriage is raised with respect to the housing 11 as shown in FIGURE 8. With the carriage thus raised, the hooks 27 are urged inwardly across the guide plates 13 as shown by the dot-dash lines in FIGURE 9. Thus, the handle 15 is entrapped above the overlapping hook means 27 and may be raised to move the crane or similar device.

It is noted that the position of the toggle 43, as shown in FIGURE 2, is stable due to the lower limited position of the link 79 which engages the left hand side of the butterfly 97, and the downward tendency of the plunger 93 due to the spring 95. Thus, the butterfly is urged in a counterclockwise direction but is limited to a position determined by the link 79. On the other hand, the position of the toggle shown in FIGURE 3 is not stable since it is dependent upon the upward extension of the plunger 63. Upon lowering the plunger 63 the position of the toggle changes from that shown in FIGURE 3 to the position shown in FIGURE 4.

Thus, after the lifting device has been raised carrying a bucket or the like, the handle 15 no longer impinges the plunger 63 and the plunger is permitted to drop under the tension of the spring 77 as shown in FIGURE 4. Upon lowering the plunger 63 the link 79 is likewise lowered and is urged in a clockwise direction about its pivot point under the tension of the spring 89. It is noted, however, that the butterfly 97 remains in its po-

sition, as shown in FIGURE 3, due to the tension of the spring **95** and the plunger **93**. The clockwise rotation of the link **79** about its pivot is limited by an extension on the butterfly **97**, and upon reaching that rotation the second stable state is reached. This stable state is such that the hooks **27** are closed, and occurs with the latch portion **41** in the position shown in FIGURE 8.

Upon the subsequent lowering of the lifting device onto the handle **15** it is apparent that the plunger **63** will again be raised and that the link **79** will cause a counterclockwise rotation of the butterfly **97** to a position as shown in FIGURE 2. The cam **49** is thereby rotated approximately 90° from the position as shown in FIGURES 7 and 8. With the cam thus rotated the latch arm **45** is free to rotate in the counterclockwise direction. Upon lowering the carriage **17** past the point where downward excursion of the outer housing **11** is interrupted by the handle **15**, the opening **53** is moved into registry with the latch arm **45**. The latch cooperates with the stop **55** to lock the carriage in its lower position. This entire operation may be carried out while the plunger **63** is still in its raised position. Upon subsequently raising the lifting device the plunger **63** is permitted to fall again due to the tension of the spring **77**. The butterfly **97** remains in its position due to the operation of the plunger **93** and the spring **95**. Upon lowering the plunger **63** the link **79** is removed from engagement on the right hand side of the butterfly and is rotated counterclockwise about its pivot due to the tension of the spring **87**. This rotation is interrupted when the link **79** contacts the left hand extension of the butterfly **97**, as shown in FIGURE 2. There the first stable state of the toggle is again reached wherein the hooks **27** are held in the open position and the lifting device may be raised away from the handle **15**.

Thus, it is seen that a new lifting device is provided in which the operation thereof does not require the assistance of an operator. Moreover, it is apparent that two stable states or conditions of the lifting device are accomplished, one wherein the lifting hooks cooperate to engage a handle or the like and a second condition wherein the lifting hooks are held free of the handle. It is likewise apparent that the operation of the lifting device does not require any external power source such as electricity for attaining the particular stable states or conditions. Moreover, these stable states and conditions are attained in the normal use of a lifting device that is upon the usual lowering and raising a hook onto a bucket or the like. In brief, the lifting device is first lowered onto the handle of a bucket and this lowering alone causes the stable condition of the hooking onto the handle to be accomplished. Upon subsequently raising the bucket and lowering it onto another position the lowering again causes another stable condition whereby the bucket may be released.

I claim:

A lifting device of the class described wherein the device is lowered onto an element to be lifted to grasp the same, lifts the element and subsequently lowers the element to release the same comprising an outer housing, a carriage vertically slidable within said outer housing, upper and lower lug means mounted on said carriage, a pair of hook means pivoted on said outer housing, said hook means including bell crank portions, one end of the bell crank portion extending through said outer housing and into operative relationship with said lug means, whereby said hook means are pivoted into and out of hooking position dependent upon the vertical position of said carriage relative to the outer housing, latch means pivoted on said outer housing, said outer housing defining an opening in registry with said latch means whereby the latch means may pass freely through the housing, latch stop means secured to said carriage in selective registry with said opening and said latch means whereby said carriage may be selectively locked at a predetermined vertical position within said housing, mechanical bistable switching means connected between said housing and said carriage and operable to switch from one of its stable states to the other in response to sequential lowering of said lifting device on to an element to be lifted, said bistable lifting means including cam means rotatable into and out of an unlatched position, said cam in its unlatched position being resiliently urged against said latch means in a direction to unlatch the same, pivoted butterfly means, linkage means coupling said butterfly means to said cam means for simultaneous rotation, all said means of said bistable switching means being mounted on said outer housing, link means pivoted on said housing, said last mentioned link means including a plunger resiliently urged onto said butterfly means and a straight portion terminating in a transverse member, plunger means slidable and vertically guided with respect to said outer housing, additional link means pivoted on said plunger means and extending to said butterfly, said additional link means impinging the surface of said butterfly opposite that impinged by said resiliently urged plunger, and means on said transverse member resiliently urging said additional link means to a position intermediate the ends of said transverse member, said latch means being placed in registry with said latch stop means in response to one of the stable conditions of said bistable switching means.

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