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3,307,871

TOGGLE DEVICE FOR LIFTING HEAVY OBJECTS

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FIG. 1

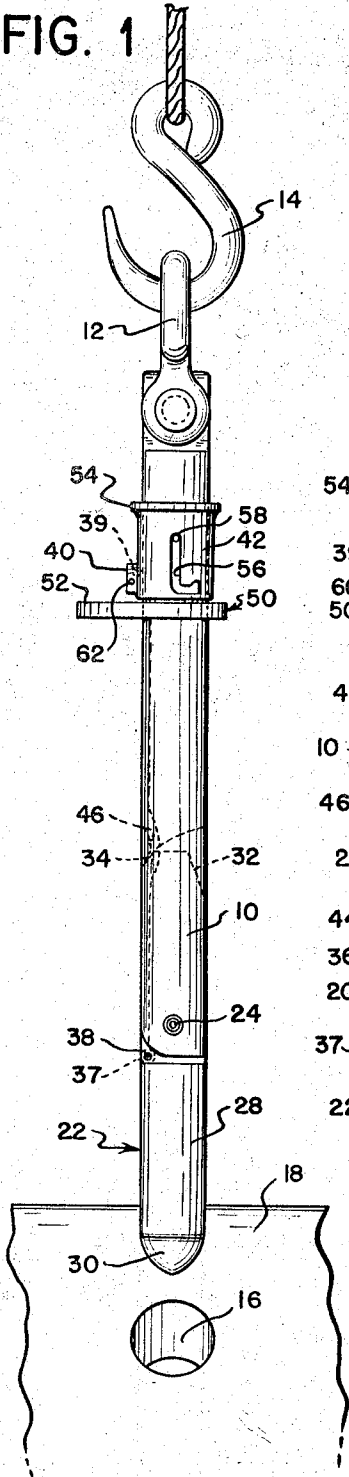


FIG. 2

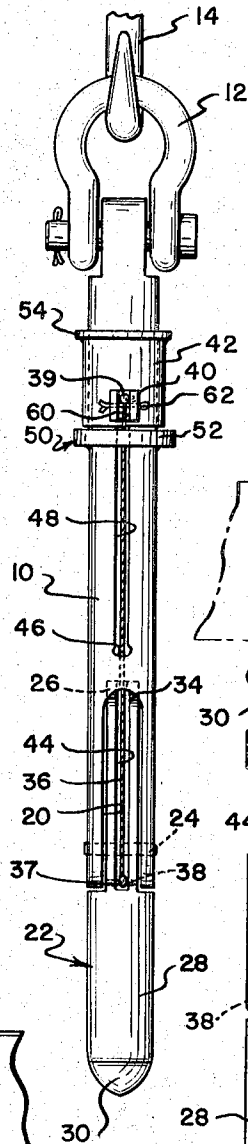


FIG. 3

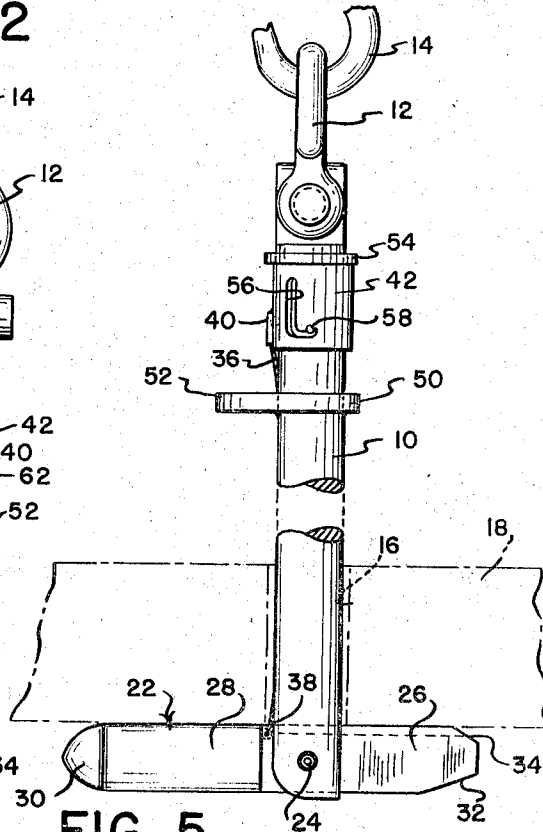


FIG. 5

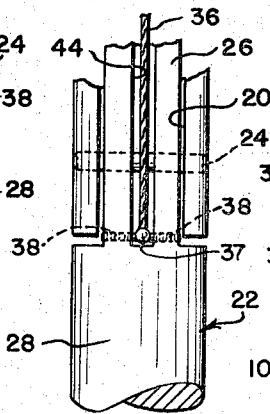
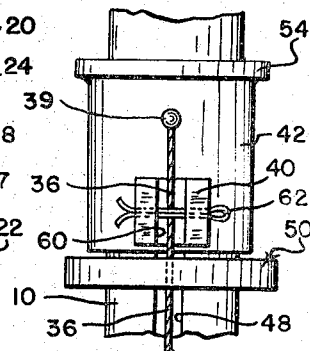


FIG. 4



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1

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TOGGLE DEVICE FOR LIFTING HEAVY OBJECTS

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This application relates to improvements in devices for lifting heavy objects, for example, concrete pipe sections of large dimensions.

Concrete pipe sections are made in various sizes but some of the larger sections run to 96 inch inside diameter with a wall thickness of about 8 inches. Some of these heavy sections are 8 feet long and weigh 8 tons or more.

The primary object of the present invention is to provide a device for engaging and lifting such concrete pipe sections, or other heavy objects with greater efficiency than previously known devices or lifting methods.

Another object of the invention is to provide a lifting device which is safe, easy to handle and is relatively light in weight compared to the weight of the objects to be lifted.

At the present time concrete pipe sections of large diameter and of from 4 to 8 feet in length, particularly those 8 feet in length, are cast with a two inch hole in the side at the lengthwise center of the section. This hole is provided in the sections of different size and weight for use in handling after the forms have been removed. Concrete plugs are cast separately for grouting-in after the concrete pipe sections have been placed.

Various means and methods have been employed for lifting and handling concrete pipe sections provided with holes in the side, but most of them are regarded as inefficient and dangerous. One of the devices used comprised a heavy eye-bolt carried by a lifting shackle and lowered through the two-inch hole in the concrete pipe section. Following this operation, a worker must go inside the pipe section and slip a plate over the end of the eye-bolt and then thread on a nut. In effecting this type of engagement with the concrete pipe section, it is necessary to have two men, one inside and one outside the pipe section. Furthermore, the time required for attachment is unnecessarily long and the man holding the plate in position with one hand and threading on the nut with the other has his hands in a very dangerous position if the crane operator should get a wrong signal and start the lifting operation.

Another procedure used for lifting heavy concrete pipe sections provided with a side hole for lifting, includes the use of a cable provided with an eye or loop at each end. Either both loops are attached on the crane hook and the center of the cable folded sharply and inserted through the two-inch hole in the concrete pipe section or one loop is attached to the crane hook and the other loop is punched down through the hole in the concrete pipe section. A man outside the pipe section is still necessary to guide the doubled portion of the cable or loop through the hole, and a second man is required inside to pull the loop down, spread it and insert a crow bar or other suitable bar through the loop. In these operations, at least the second man's hands and fingers are in danger, and accidents have happened. When a man spreads the loop with one hand and inserts the bar through the loop with the other hand, both hands are in a very dangerous position.

In accordance with the present invention, an engaging and lifting toggle device is provided which avoids the dangers and difficulties referred to above, and one which requires only one operator. All this single operator has to do in the lifting of heavy objects such as concrete pipe

2

sections, is to guide the lower portion of the lifting toggle device into the two-inch hole from the outside and operate a toggle actuating means located on the upper part of the device. With this the engagement of the concrete pipe section by the device is complete and ready for lifting, and the operator's hands are never in a dangerous position.

In a more particular sense, the improved lifting toggle device of the present invention, which is used for lifting heavy objects of the type referred to above comprises a lifting toggle mechanism including an elongated body member or stem adapted to be guided through a hole, such as a two-inch hole in a concrete pipe, of the type referred to above, or other object having an opening through which a portion of the lifting toggle device may pass. The elongated body of the device carries an elongated toggle member adjacent its lower end which is pivoted intermediate its ends to the body member and is swingable into a first position in which it is in alignment with the elongated body for insertion into the opening in the object to be lifted. The toggle member is also swingable from the first position referred to into a second position in which it extends transversely of the elongated body member for engaging with the object to be lifted and for retaining the lifting device in engagement therewith. The lifting toggle mechanism includes means for pivoting the toggle member from the first position to the second position in which it can engage and support the object to be lifted.

In a preferred construction the toggle member, pivoted intermediate its ends to the lower end portion of the elongated body of the device, is unbalanced on its pivot, that is, one end of the toggle is heavier than the other end and is arranged to swing downwardly and automatically bring the toggle member into alignment with the elongated body of the device when the device is lifted and the toggle member is in released position.

The lifting toggle device of the present invention includes other features, objects and advantages as described more in detail hereinafter in connection with the accompanying drawings forming a part of this application.

In the drawings;

FIG. 1 is an elevational view of a lifting toggle device constructed in accordance with the present invention and supported in position ready to be guided through a lifting hole in a heavy concrete pipe section;

FIG. 2 is an elevational view of the device shown in FIG. 1 rotated through an angle of 90°;

FIG. 3 is an elevational view of the device shown in FIGS. 1 and 2 engaging the wall of a heavy concrete pipe section, with the toggle member pivoted into position for securing the lifting device to the concrete pipe section;

FIG. 4 is an enlarged broken elevational view showing the details of construction of the toggle pivoting means and its released position when the toggle member is in the position shown in FIG. 3; and

FIG. 5 is an enlarged broken elevational view showing the details of other portions of the lifting device in the position shown in FIG. 2.

The lifting toggle device illustrated in the drawings comprises an elongated cylindrical solid steel body or stem 10 having a diameter such that it may be guided easily through a hole or opening provided in the object to be lifted or handled, such as an 8 ton cast concrete pipe section 8 feet in length. The steel body 10 is attached to and supported by a clevis 12 carried by a crane hook 14 by which the device is suspended over a hole 16 in a cast concrete pipe section 18, as shown in FIG. 1. The lower portion of the body 10 is provided with a through slot 20, as shown in FIGS. 2 and 5.

A toggle member 22 is pivotally mounted in the lower portion of the slot 20 by a toggle pin 24 which extends

3

through a portion 26 which is receivable within the slot 20 when the toggle member 22 is in the position shown in FIGS. 1 and 2. The toggle member 22 is made from a solid cylindrical piece of steel having about the same diameter as that of the body 10 and is cut away on opposite sides to leave the portion 26 while the opposite end portion 28 of the toggle member 22 is cylindrical and provided with a pointed end 30. The end portion 28 is, therefore, considerably heavier than the end portion 26 and provides a very important and desirable feature, that is, an unbalanced, pivoted toggle member, which when released from the position shown in FIG. 3 automatically assumes the position shown in FIGS. 1 and 2, when the lifting device is suspended in the upright position shown in FIGS. 1 and 2.

The pointed end 30 aids in guiding the body of the lifting device into the hole 16 of the pipe section 18. The opposite end edges of the end portion 26 of the device are beveled at 32 and 34 to eliminate any abrupt corners on the upper end of the toggle member 22 when it is in the position shown in FIGS. 1 and 2, thereby avoiding engagement with the inside of a hole when the toggle member 22 is at a slight angle with respect to its position as shown in FIGS. 1 and 2, and the body 10 is being withdrawn from a lifted object.

The toggle member 22 is rotated from its aligned position as shown in FIG. 1 to the position shown in FIG. 3 by means of a steel cable 36 carrying a ball 37 at its lower end and a ball 39 at its upper end. The lower end of the cable 36 is retained in the lower end of a slot 44 in the toggle part 26 at a position spaced from the pin 24 and adjacent the edge of the part 26, as shown in FIG. 3, by two retaining screws 38 threaded in from the opposite sides in the manner shown in FIG. 5.

The upper end of the cable 36 is secured in a steel block 40 mounted on a sleeve 42 extending around and slidable on the upper portion of the body 10. In the position of the toggle member 22 as shown in FIGS. 2 and 5, the cable 36 lies in the slot 44 in the adjacent edge of the end portion 26. The cable then extends through an opening 46 from the upper end portion of the slot 20 into a vertical slot 48 running from the opening 46 upwardly along the portion of the body 10 to the position of the sleeve 42.

The sleeve 42 has a limited range of movement along the shaft or body 10 sufficient to pivot the toggle member 22 from the position shown in FIGS. 1, 2 and 5 to the horizontal position shown in FIG. 3. In FIGS. 1 and 2 the sleeve 42 rests on a combined toggle member-direction indicator and stop collar 50 which is fixed to the shaft 10, by welding or otherwise, so that its projecting indicator portion 52, shown in FIGS. 1 and 3, extends in the direction which the weighted upwardly-swinging part 28 of the toggle member 22 points. An operator, standing on a concrete pipe section, can orient the device by pointing the indicator 52 so that the toggle member 22 extends lengthwise of the pipe section when it is pivoted to the position shown in FIG. 3.

The sleeve 42 is provided at its top with a peripherally-extending flange 54 to prevent the operator's hands from slipping off the sleeve while raising it from the position shown in FIGS. 1 and 2 to that shown in FIG. 3. The sleeve is also provided with an L-shaped guiding and locking slot 56, shown in FIGS. 1 and 3, into which a pin 58, set in the shaft 10 extends. This pin guides the sleeve 42 vertically as it is lifted so that the cable 36 is pulled up straight, after which the sleeve is slightly rotated to the position shown in FIG. 3, in which the sleeve is latched in its upper position and holds the toggle member 22 in its transverse position, also as shown in FIG. 3.

The cable 36 is a relatively stiff steel cable, and its ends are held so that it is normally retained in the slots 44 and 48. The balls 37 and 39 are respectively swedged to the ends of the cable 36. The two screws 38 are preferably cupped Allen screws, which when inserted, act to provide

4

a socket in the slot 44 for the ball 37 on the lower end of the cable 36.

The upper end of the cable 36 is secured in the steel block 40 in the manner shown in FIGS. 2 and 4, in which the block 40 is shown as being provided with a milled-out vertical slot 60 for receiving the cable 36. The ball 39 at the upper end of the cable is movable in the slot 60, but is prevented from sliding through the block by a small spring type pin 62 such as a cotter pin extending transversely through suitable small holes drilled in the block. This pin prevents the cable from leaving the slot in the block but still allows the sleeve 42 to be lowered without applying a down pressure on the cable 36. This is necessary to prevent the buckling of the cable which would cause undue chafing or wear while the toggle member 22 is in the lift position, as shown in FIG. 3 and sleeve 42 is in the unlocked, release position as shown in FIG. 4.

While there may be some variation in the manner of operating the lifting device, a suitable procedure carried out by a single operator includes the step of guiding the lifting toggle device at the position shown in FIG. 1, so that the point 30 enters the hole 16 in pipe 18. The device is then lowered until the collar 50 comes into contact with the upper surface of the pipe 18. The operator, standing on the pipe, then lifts the sleeve 42 and turns it into the locking position shown in FIG. 3. This operation brings the toggle member 22 to the transverse position as also shown in FIG. 3. The collar extension or indicator 52 is preferably pointed in the lengthwise direction of the concrete pipe section. The crane operator is then signaled to take a strain on the lifting cable until the toggle member 22 is in contact with the inside of the pipe section. The operator then rotates the sleeve 42 to the unlocked position and lowers it to the release position shown in FIG. 4. Since the toggle member 22 is in the lift position and the sleeve 42 is in the release position, the cable 36 is held in its upper position by the toggle member 22, as the block 40 slides along the cable with the sleeve 42 to the release position shown in FIG. 4. The ball 39 is then above the pin 62 as shown in FIG. 4.

After the lift device operator has completed the foregoing steps, the crane operator lifts the pipe and when it is set in the desired position, he lowers the lifting toggle device until the stop collar 50 comes in contact with the top of the pipe section, in which position the toggle member 22 because of its weighted end 28 operates automatically to pull the cable down and assume the position shown in FIGS. 1 and 2. In this position the ball 39 rests on the pin 62. The crane operator then lifts the device out of the hole and is ready to move to another pipe section. In these operations, no worker is required to enter the concrete pipe or other object to be lifted or to handle any part of the device which might cause him injury.

The improved lifting toggle device of the present invention is preferably machined from special high strength alloy steels. In the particular example described a device made in this way, as determined by tests, has a safety factor of approximately four to one. The arrangement of the cable 36 in the slots 44 and 48 prevents chafing of the cable while entering, in use and on leaving the lift holes in concrete pipe sections. Furthermore, the point of attachment of the lower end of the cable to the toggle member, in an offcenter position permits the pivoting of the toggle member without chafing the cable. If, after a large concrete pipe is lifted, it rolls so that the hole and lifting toggle are to one side, or are inclined from the vertical, the toggle will operate automatically, in the horizontal position, when the lifting pressure is released, if the indicator 52 is pointed upward and the device is pushed into the pipe 18 until indicator 52 engages with the pipe. In this position, end 26 of toggle 22 will clear the inside wall of the pipe when weighted end 28 of

5

toggle 22, causes toggle 22 to pivot to the release position as shown in FIGS. 1 and 2.

While the cable 36 and the sleeve 42 are particularly advantageous and the preferred form of the actuating means for the toggle 22, it will be understood that a rod or equivalent means, pivoted at the position of the cup ended screws 38, and operated by a suitable handle and latch, may be utilized for actuating the toggle 22. The cable 36 with a ball at each end is a convenient and readily removable and replaceable lifting means, and a damaged cable may be removed by simply releasing the screws 38 and removing the pin 62. The member 50 is slotted at least at its upper portion to accommodate a portion of the cable when the sleeve 42 is down.

While the lifting device of the present invention is particularly useful in lifting and handling heavy concrete pipe sections, as described, it may be used in the manner of a harpoon for engaging in any object to be lifted or in a cable, chain or other means attached to an object to be lifted.

While the shaft 10 or body of the lifting mechanism and the toggle member 22 may be made of heavy round steel or alloy steel bar stock, it is to be understood that the shaft may be made up of steel or two alloy steel bars secured to a somewhat narrower steel bar above the slot 20 so as to leave the slot 48 and provide the pair of legs on the respective sides of the slot 20. The toggle member may be made out of a heavy steel bar pivoted to one side of its longitudinal center on the pivot pin 24 between the lower end portion of the legs of the shaft. The toggle member will, therefore, be unbalanced and normally assume the position shown in FIGS. 1 and 2.

We claim:

1. In a lifting toggle mechanism for lifting heavy objects in which the object to be lifted is adapted to be engaged by a portion of the lifting toggle mechanism, said lifting toggle mechanism including an elongated shaft provided with a lifting attachment at its upper end, an elongated toggle member pivoted intermediate its ends to the lower end portion of the elongated shaft, said toggle member being swingable into a first position in which it is in general alignment with the elongated shaft for movement with the lower end portion of the shaft into engagement with the object to be lifted, and said toggle member being swingable from said first position into a second position in which it extends transversely of said shaft for anchoring the lifting toggle mechanism in a lifting relation to the object to be lifted, wherein the improvement comprises pull means attached to one end portion of the toggle member near but spaced from its pivot point and extending upwardly along the shaft to the upper portion thereof for positively swinging the toggle member from its first position with respect to the shaft into its second and lifting position in which it extends transversely of said shaft, and an operating handle means mounted on the upper portion of the shaft to which said pull means is connected.

2. A lifting toggle mechanism as claimed in claim 1, including means for latching the handle means in a position to hold the toggle member in its second position.

3. A lifting toggle mechanism as claimed in claim 1, in which the shaft is provided with a passageway through which the pull means extends, thereby avoiding chafing of the toggle member by the object to be lifted.

4. A lifting toggle mechanism as claimed in claim 1, in which the toggle member is unbalanced on its pivot whereby it will automatically swing to its first position in which it is in alignment with the shaft, unless held from pivoting relative to the shaft.

5. A lifting toggle mechanism as claimed in claim 4, in which the two end portions of the toggle member are of unequal weight.

6. A lifting toggle mechanism as claimed in claim 4,

6

wherein the end portions of the toggle member are of similar length, and in which one end portion is heavier than the other and extends downwardly substantially entirely below the lower end of the shaft when the toggle member is in its first position.

7. A lifting toggle mechanism as claimed in claim 1, including an indicator means at the upper portion of the shaft projecting in a direction to indicate the orientation of the toggle member when in its second position.

8. A lifting toggle mechanism as claimed in claim 1, in which the lower portion of the elongated shaft comprises two spaced parallel legs separated by a through slot, said toggle member extending between the lower portions of said legs and pivoted at a point intermediate its ends therebetween, one end portion of the toggle member being adapted to occupy the through slot between said legs while the other end portion extends substantially entirely below the lower end of the shaft when the toggle member is in its first position in alignment with the shaft.

9. A lifting toggle mechanism as claimed in claim 8, wherein the lower end of the pull means is attached to the edge portion of the toggle member at a point somewhat below the pivot point when the toggle member is in its first position, and a groove extending along the edge portion of said one end portion of the toggle member for receiving the pull means when the toggle member is in its first position.

10. A lifting toggle mechanism as claimed in claim 1, in which the handle means comprises a vertically movable sleeve surrounding the shaft at its upper portion, and in which the pull means comprises a length of cable the upper end of which is loosely secured to said sleeve, whereby said sleeve may be lowered without lowering the cable when the toggle member is in lifting engagement with an object to be lifted.

11. A lifting toggle mechanism as claimed in claim 10, wherein said toggle member is unbalanced and in which one end portion is heavier than the other and normally extends downwardly below the end portion of the shaft when the toggle member is in its first position, said toggle member being adapted to automatically return from its second position to its first position upon lowering of the toggle mechanism after lifting an object, whereby said toggle mechanism may be withdrawn directly from said object.

12. A lifting toggle mechanism as claimed in claim 1, in which the pull means comprises a line loosely attached to the handle in a manner such that when the handle is moved upwardly it pulls the line and swings the toggle member to its second position, said handle being movable downwardly to the toggle member release position without moving the line downwardly when the toggle member is in lifting engagement with an object to be lifted, whereby the toggle member will automatically assume its first position when a lifting pull on the toggle mechanism is relaxed.

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