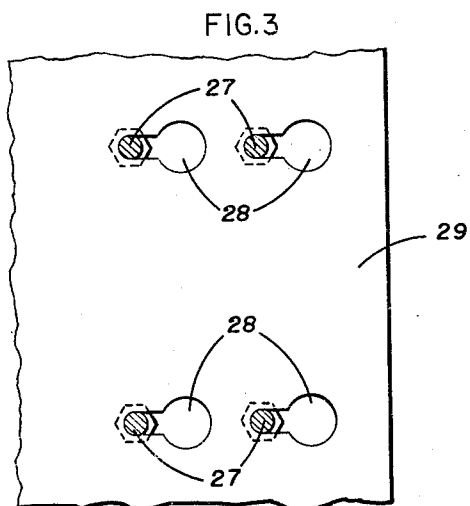
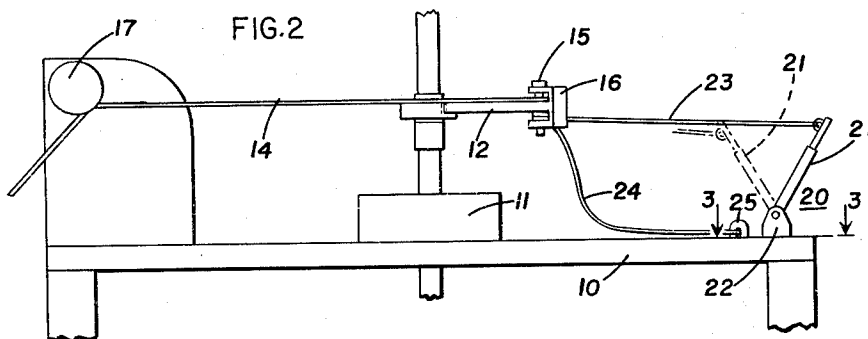
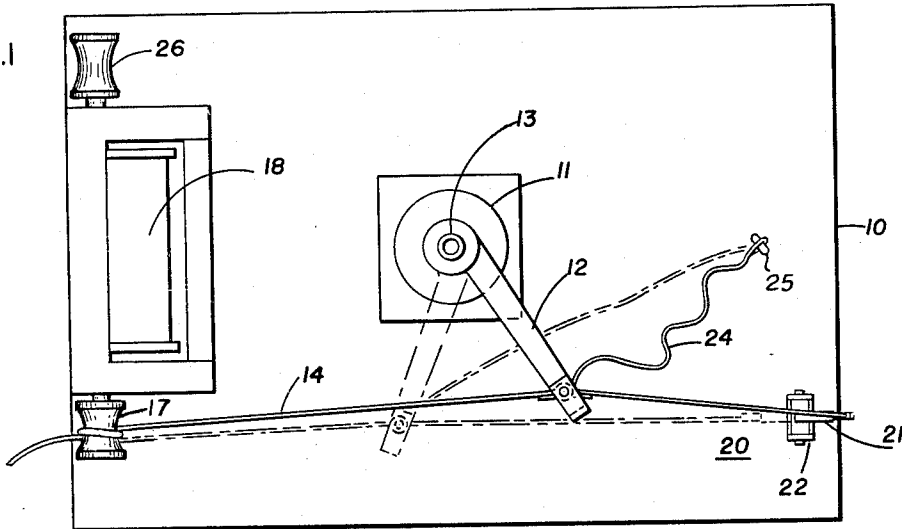


D. L. HARDISON
TONG RETURN DEVICE

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FIG.1



INVENTOR:
DEAN L. HARDISON,
BY *W. B. Edwards*
ATTORNEYS.

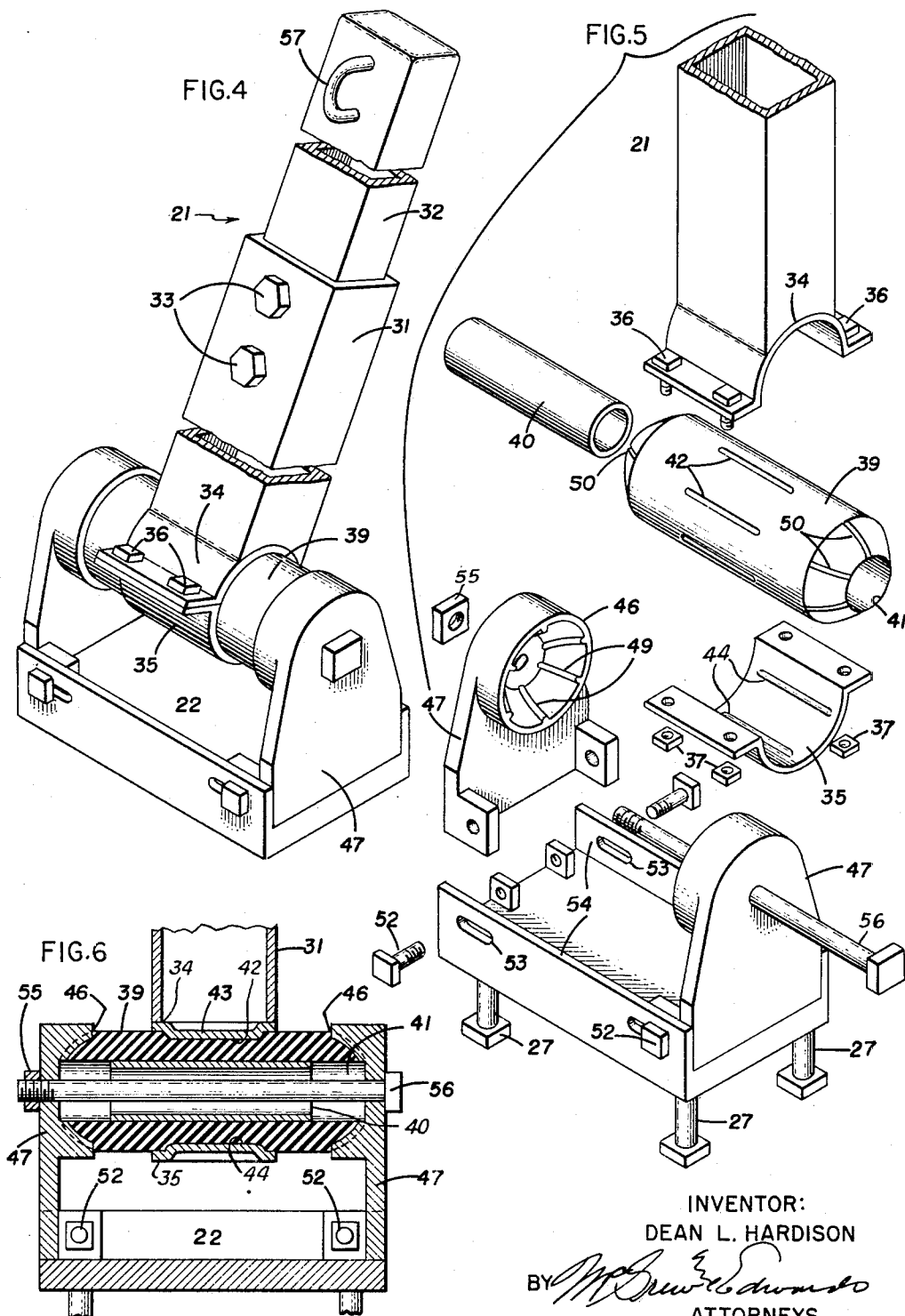
Feb. 11, 1964

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TONG RETURN DEVICE

3,120,950

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INVENTOR:
DEAN L. HARDISON
BY *W. Edwards*
ATTORNEYS.

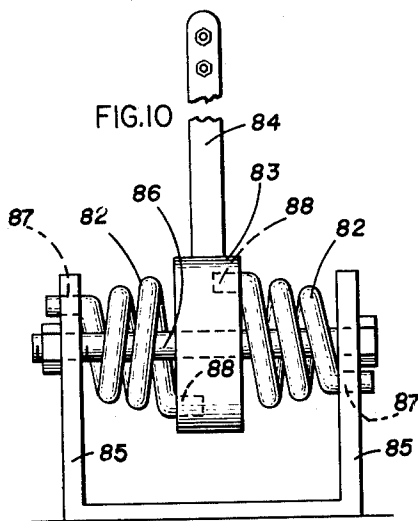
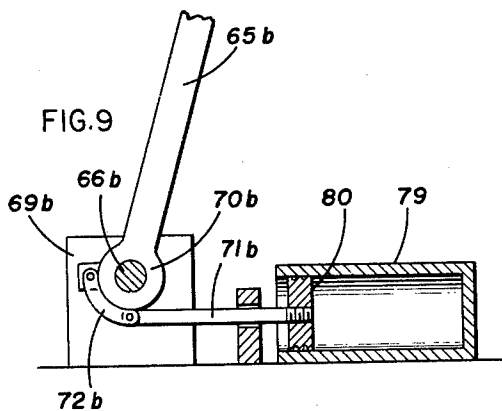
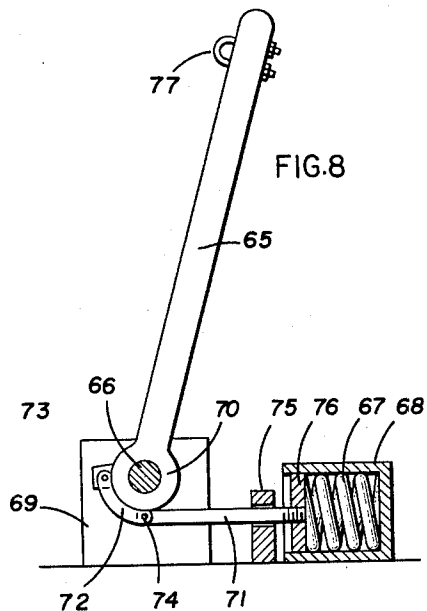
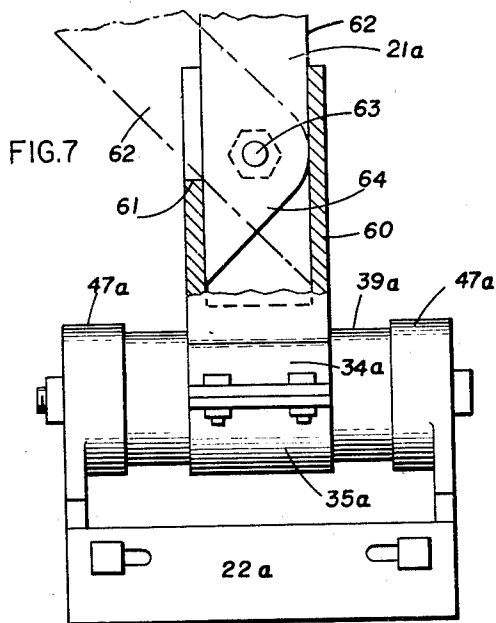
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D. L. HARDISON
TONG RETURN DEVICE

3,120,950

Filed June 5, 1959

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INVENTOR:
DEAN L. HARDISON,
BY *W. B. Edwards*
ATTORNEYS

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3,120,950

TONG RETURN DEVICE

Dean L. Hardison, Casper, Wyo.
(P.O. Box 476, St. Maries, Idaho)

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5 Claims. (Cl. 267—1)

This invention relates to well rig equipment and the like and particularly to an improved device for returning tongs or ratchet wrenches to their ready or starting positions.

In well drilling equipment the tubular sections of the drill string and also the sections of the well casing are secured to one another by threaded connections and it is necessary to turn the sections by a suitable wrench or tong in order to connect or disconnect them. The tong is conventionally in the form of a one-way gripping or ratchet wrench having a long handle which is rotated by a cable and capstan to move the tongs forward and effect the turning movement; the tong handle must then be returned to its starting position for the next operation. This return movement has been effected by various devices including long helical springs and weight and pulley assemblies. While these devices have operated in a generally acceptable manner, they have not been entirely satisfactory for all installations and have required the use of substantial space and furthermore in many cases have required unusual safety precautions. Accordingly, it is an object of this invention to provide an improved tong return device for well rigs and the like which is of simple and compact construction.

It is a further object of this invention to provide an improved tong return device which is of simple and compact construction and is easy to install.

It is a further object of this invention to provide an improved tong return device which is of simple construction and provides greater safety in operation.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Briefly, in carrying out the objects of the invention in one embodiment thereof a tong return unit is provided which includes an elongated arm swingably mounted on a base which may be rigidly attached to a supporting structure on a well rig. Between the arm and the base there is provided a hub structure in the form of a block of rubber or similar material which is twisted on movement of the arm and provides the required restoring force or torque for moving the tong back to its starting position. The center portion of the hub is clamped to the arm and is compressed about a tubular core arranged in a hollow passage in the center portion of the hub. The hub is also clamped longitudinally between end pieces secured to the mounting base and the rubber material is thus held under compression. Interfitting projections and grooves in the end plates and arm clamp and the rubber block prevent relative rotation between the block and these respective parts.

Other embodiments of the invention include arrangements wherein steel springs provide the required torque, and in one embodiment a compressible gas confined in a cylinder and piston assembly is employed to secure the restoring force.

For a better understanding of this invention, both as to its organization and method of operation, reference may be had to the accompanying drawings in which:

FIG. 1 is a plan view of a well rig provided with a tong return device embodying the invention;

FIG. 2 is an elevation view of the rig of FIG. 1;

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FIG. 3 is an enlarged view of a portion of the base of the device of FIG. 1;

FIG. 4 is an enlarged perspective view partly broken away of the device of FIG. 1;

FIG. 5 is an exploded view showing the details of construction of the device;

FIG. 6 is a sectional view of the base portion of the device;

FIG. 7 is a front elevation view of a modified form of the invention;

FIGS. 8 and 9 are side elevation views of two other embodiments of the invention; and

FIG. 10 is a front elevation view illustrating a further embodiment of the invention.

Referring now to the drawings, the well rig illustrated in FIG. 1 comprises a platform 10 surrounding the well head indicated generally at 11. A tong wrench 12 has been illustrated in engagement with a tubular section 13 of the drill string assembly. The tong 12 is set for attaching the section 13 to the next section of the assembly and for this purpose rotates the section in a clockwise direction. The rotation of the tong is effected by a cable 14 attached to the end of the tong by means of a pin 15 passing through rearwardly turned lugs in the end assembly of the tong indicated at 16. The cable 14 is passed about a capstan 17 driven by a motor 18, and on tightening of the cable on the capstan, the tong is drawn toward the capstan and rotates the casing 13 in a clockwise direction. At the end of the stroke of the tong the cable is loosened on the capstan and is released, whereupon the tong is returned to its ready or starting position by operation of a return device 20 embodying the invention.

The device 20 includes an adjustable elongated arm 21 swingably mounted in a base 22 on a horizontal axis and connected to the tong 12 by a cable 23 which is secured to the end assembly 16 by the bolt or pin 15. A safety cable 24 attached to a fixed ring 25 on the platform 10 and having its other end secured by the pin 15 on the backwardly forked end of the tong assembly limits the rotation of the tong. The return movement of the tong acts in the manner of a ratchet and the tong is ready to grip the tube 13 and again be drawn forward to rotate the tube in a clockwise direction. The forward and return operations are repeated until the tube has been threaded into position.

In the event that the tube 13 is to be disconnected from the string, the wrench is applied in the opposite direction and will extend from the other side of the well head where it can be actuated by extending the cable 14 about a second capstan indicated at 26. For purposes of effecting the return movement the return device 20 may be employed or if desired a second similar device may be arranged on the opposite side of the platform 10.

It will readily be apparent that the device 20 occupies a relatively small space and is easily connected with the tong in a position where it may be seen at all times by the operator and furthermore, being of relatively small size, it may be easily provided with an enclosing guard.

The details of construction of the tong return device are shown in FIGS. 3 to 6, inclusive. The base of the device 22 as indicated in FIGS. 3, 5 and 6 is provided with bolts 27 which may readily be inserted in keyhole or bayonet slots 28 provided in an I-beam or other rigid structural part of the platform 10, a portion of the beam being indicated at 29 in FIG. 3.

As shown in FIGS. 4, 5 and 6, the arm 21 of the return device comprises telescoped tubular sections 31 and 32 which are of rectangular cross section and may be moved relatively to one another and secured in desired positions by tightening bolts 33 so that the length of the arm may be adjusted. The lower end of the section 31 of the arm

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is provided with a clamping device comprising a cylindrical portion 34 formed on the tube 31 and a detachable clamping portion 35 secured to the portion 34 by bolts 36 extending downwardly through flanges on the section 34 and similar flanges on the section 35 to which they are secured by nuts 37.

The arm 21 is clamped about a cylindrical member 39 which is molded or is cut from a block of tough resilient rubber or similar material and is provided with a tubular metal core 40 lying in the central area thereof in a tubular passage 41 as clearly shown in FIG. 6. The rubber block or cylinder 39 is provided with a plurality of longitudinal grooves 42 about its central portion and these are engaged by complementary ridges or projections 43 in the clamping portion 34 and projections 44 in the clamping portion 35. The interengaging grooves and projections of the block and clamp assembly prevent rotation of the block 39 in the clamp. The ends of the block 39 are of generally rounded configuration and fit in cups or sockets 46 formed in end members 47 of the base 22. The configuration of the cups and of the ends of the block 39 provides a close fit and furthermore the cups are provided with ridges 49 which engage complementary grooves 50 formed in the ends of the block 39. Thus when the end pieces 47 are clamped in position against the ends of the block 39, relative rotation of the parts is prevented.

The blocks 47 are adjustable longitudinally of the base 22 and are secured thereto by bolts 52 fitting in slots 53 in upturned flanges 54 of the base 22. The end pieces 47 are drawn together to compress the rubber block 39 by tightening a nut 55 on a bolt 56 which passes through the end members 47 and through the central passage within the block 39. In setting up the assembly one of the end pieces 47 is first securely bolted to the base 22 and the nut 55 is then tightened to the desired degree to provide compression of the block 39 and hold it securely in position against the metal supporting posts, whereupon the bolts 52 of the other end piece are clamped so that both end pieces are securely held on the base 22.

It will now be seen that the clamping member comprising the parts 34 and 35 securely holds the arm 21 in position on the hub or block 39 which is in turn rigidly held in position between the end pieces 47. As shown in FIG. 6, a portion of the rubber material of the block 39 is free from attachment to the metal parts of the assembly adjacent each of the end pieces. When the arm 21 is rotated away from its normal position, the block 39 is thus twisted and provides the restoring force or torque necessary to return the tong to its starting position.

It has been found that this arrangement of a rubber block provides a very effective torque return device. It will be noted that there are no relatively moving parts which rub against one another and produce friction and wear and that the entire relative movement is secured by distortion of the rubber block. It has been found that this construction provides reliable operation over prolonged periods and requires little attention to keep it in operating condition, it being necessary merely to maintain the required pressure of the clamping device at the end of the arm 21 and the clamping of the two end pieces against the block, the clamping pressure being sufficiently high to prevent relative movement of the parts of the mechanism with respect to the rubber block 39.

During operation of the tong return assembly the base 22 is securely attached to the frame of the platform 10 and the cable 23 is secured to the arm by means of a loop or eye 57 provided at the outer end of the arm. The extent of movement of the device 21 and of tong 12 is indicated by the dotted line showing on FIG. 1 wherein it will be noted that the safety cable 24 has been moved substantially to its outermost position and is slack upon return to its starting position which is indicated in full lines. The forward position of the arm 21 is also indicated by dotted lines in FIG. 2.

In some installations it is desirable to adjust the angu-

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lar position of the arm in the plane of its axis of rotation, and in FIG. 7 there is illustrated an arrangement of the arm whereby this may be accomplished. In FIG. 7 corresponding parts of the assembly have been designated by the same numerals as employed in FIGS. 1 through 6 with the addition of the suffix letter "a."

The arm 21a of FIG. 7 comprises a base portion 60 which is in the form of a socket of rectangular cross section having one wall cut away as indicated at 61. The main body portion of the arm indicated at 62 is pivotally secured within the socket member 60 by a bolt 63. This arm portion is provided with an angularly cut lower end which in the illustration shown is at an angle of substantially 45° as indicated at 64. When the bolt 63 is loosened the arm 62 may be moved to the dotted line position wherein the face 64 lies against the wall of the socket 60 opposite the opening 61 and the arm extends through the opening 61. When the bolt 63 is tightened this provides a rigid connection of the arm at an angle which affords mounting of the base 22 in a position offset from the line of movement of the cable attached to the tong.

In FIG. 8 there is shown an embodiment of the invention wherein an arm 65 pivotally mounted on a shaft 66 is biased to the full-line position shown by a compression spring 67 mounted in a housing 68 rigidly attached to the supporting structure. The shaft 66 is rigidly secured in a base structure 69 and the hub of the arm 65, indicated at 70, is connected to an operating rod 71 of the spring 67 by an arcuate link 72 pivoted to the hub at 73 and to the link 71 at 74. A guide block 75 is provided through which the rod 74 passes and a guide plunger 76 secured to the end of the rod 71 engages the spring 67. When the arm 65 is rotated in a counterclockwise direction by a tong cable which may be attached to a loop 77, the rod 71 is moved to the right and compresses the spring 67, thereby building up the required restoring force.

In FIG. 9 there is illustrated an embodiment similar to that of FIG. 8 and corresponding parts have been designated by the same numerals with the addition of the letter "b." This modification differs from that of FIG. 8 in that a closed compression cylinder 79 filled with air or a suitable gas is employed, the cylinder being provided with a piston 80 which is moved to the right upon rotation of the arm 65b through operation of the rod 71b so that gas within the chamber 79 is compressed and provides a restoring force when the arm 65b is released.

In FIG. 10 there is illustrated an arrangement wherein two tapered helical springs 82 are provided one on either side of the hub 83 of an arm 84, the assembly being mounted in a base having upstanding end plates 85. The arm 84 is mounted on a shaft 86 secured between the end plates and about which the springs 82 are arranged, and the springs have their outer ends secured in holes drilled in end plates 85 as indicated at 87 and their inner ends are secured in holes drilled in the hub 83, as indicated at 88. Upon rotation of the arm 84 about the shaft 86 restoring force is stored in the springs 82 and effects return of the arm on release.

While the invention has been described in connection with specific structural arrangements, various modifications and other applications will occur to those skilled in the art. Therefore it is not desired that the invention be limited to the details of construction illustrated and described and it is intended by the appended claims to cover all modifications which fall within the spirit and scope of the invention.

I claim:

1. In a well rig equipment including a ratchet-type tong or the like and power means for operating the tong, a tong return unit comprising a support attaching the unit to a rig platform or the like, an elongated arm, means securing said arm to said support for swinging movement

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toward and away from a well head and for biasing said arm to return to a predetermined starting position on said support, means connecting the outer end of said arm to the outer end of the tong for operating movement with the tong against the resistance of said means for securing and biasing whereby upon release of the tong said means for securing and biasing returns the tong to its starting position, and means for adjusting the angular position of said arm about an axis transverse to the swinging axis of said arm without dismantling the unit.

2. A tong return device for well rigs and the like comprising a base for attaching the device to a fixed support, an elongated arm, means for swingably mounting said arm on said base and for biasing said arm toward a predetermined position, means on said arm remote from said last mentioned means for connecting the outer end of said arm to the tong, said mounting means comprising a block of solid resilient rubber-like material fixedly secured to the inner end of said arm and constituting a hub therefor and means securing said block to said base whereby swinging movement distorts said block and creates a restoring force to return said arm toward said predetermined position, and means for adjusting the effective length of said arm between said mounting means and said tong connecting means.

3. A tong return device for well rigs and the like comprising a base for attaching the device to a fixed support, an elongated arm, means for swingably mounting said arm on said base and for biasing said arm toward a predetermined position, said mounting means comprising a block of solid resilient rubber-like material fixedly secured to the inner end of said arm and constituting a hub therefor and means for securing said block to said base whereby swinging movement distorts said block and creates a restoring force to return said arm toward said predetermined position, said block extending transversely of the longitudinal axis of said arm and being provided with a longitudinal central passage, said arm having rigid clamping means gripping the central portion of said block and said block extending beyond said clamping means at both sides of said arm, a rigid tubular member in said passage in the central portion of said block for preventing collapse of said passage by said clamping means, and means mounted on said base and connecting both ends of said block in stationary relationship to said base for gripping said ends and for compressing said block longi-

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tudinally of said passage, said block having free portions near both ends between said gripping means and said clamping means so as to allow movement of the central portion relative to the stationary ends of said block.

4. A tong return device for well rigs and the like comprising a base for attaching the device to a fixed support, an elongated arm, means for swingably mounting said arm on said base and for biasing said arm toward a predetermined position, said mounting means comprising a block of solid resilient rubber-like material fixedly secured to the inner end of said arm and constituting a hub therefor and means for securing said block to said base whereby swinging movement distorts said block and creates a restoring force to return said arm toward said predetermined position, said block comprising a hub of cylindrical form having a central passage transverse to the longitudinal axis of said arm, said hub extending beyond the sides of said arm, a clamp on the inner end of said arm about said block, a rigid tubular member within the passage in said block for resisting the pressure of said clamp, said block and said clamp having interfitting grooves and projections for preventing rotation of said clamp on said block, and clamping means on said base comprising end members engaging the end portions of said block and means for urging said end members toward one another to compress said block, said block and said end members having interfitting portions to prevent rotation thereof relative to the central portion.

5. A tong return unit as set forth in claim 4 wherein said end members are of cup-like form and said means for urging them together comprises a bolt extending through the passage in said block and arranged to draw said members toward one another against said block along its longitudinal axis.

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