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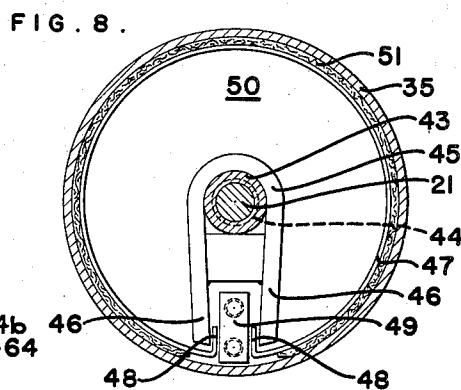
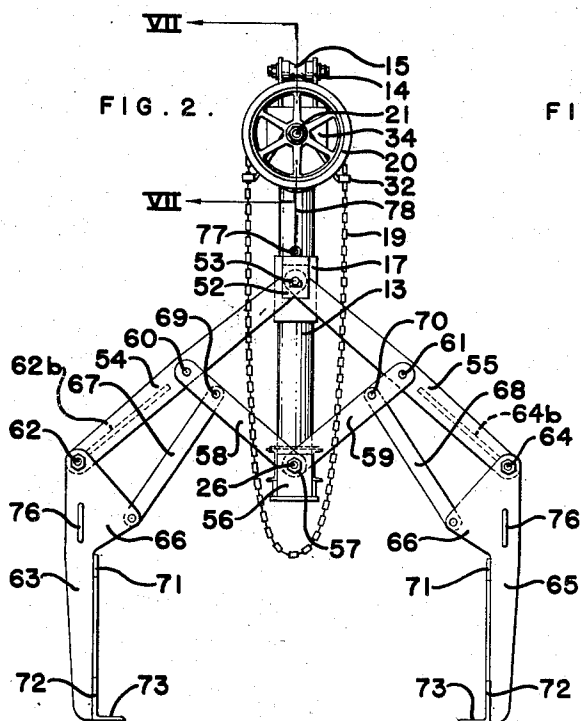
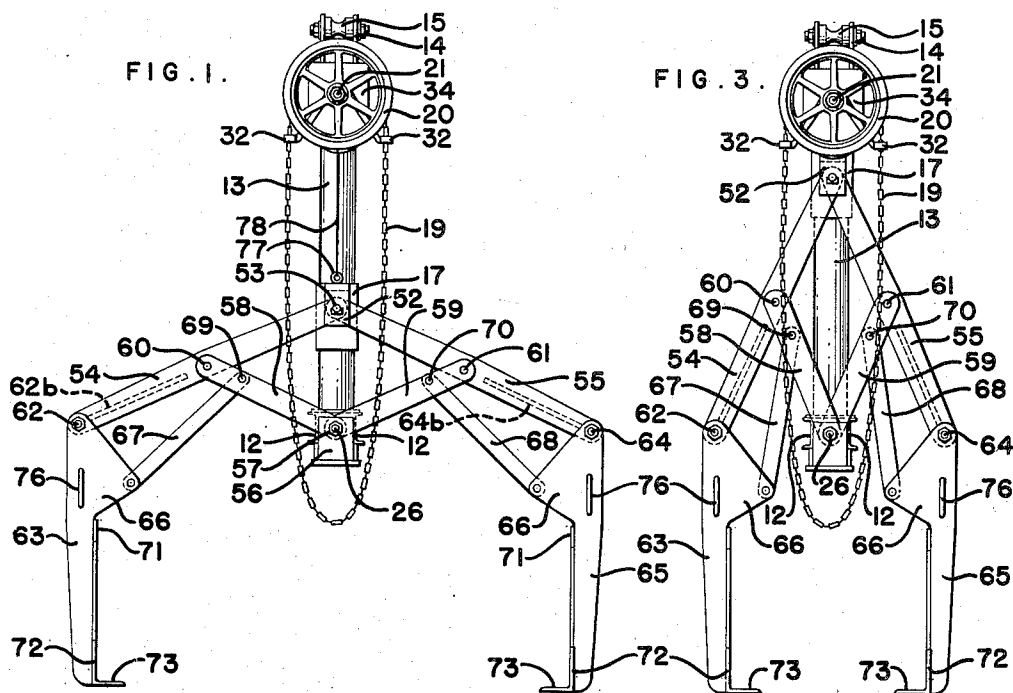
M. R. HEPPENSTALL

2,857,193

TONGS

Filed July 11, 1955

6 Sheets-Sheet 1



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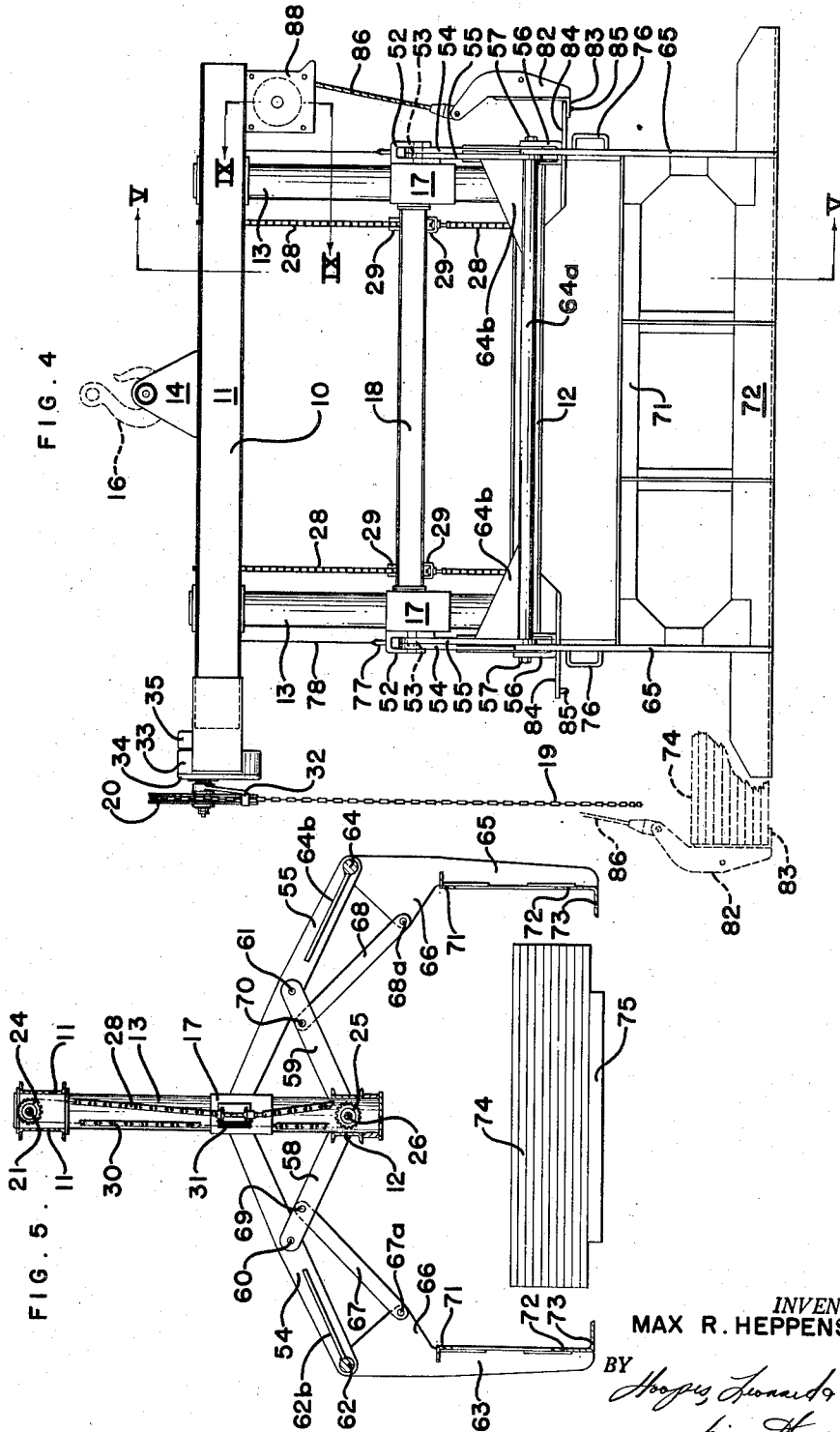
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6 Sheets-Sheet 2



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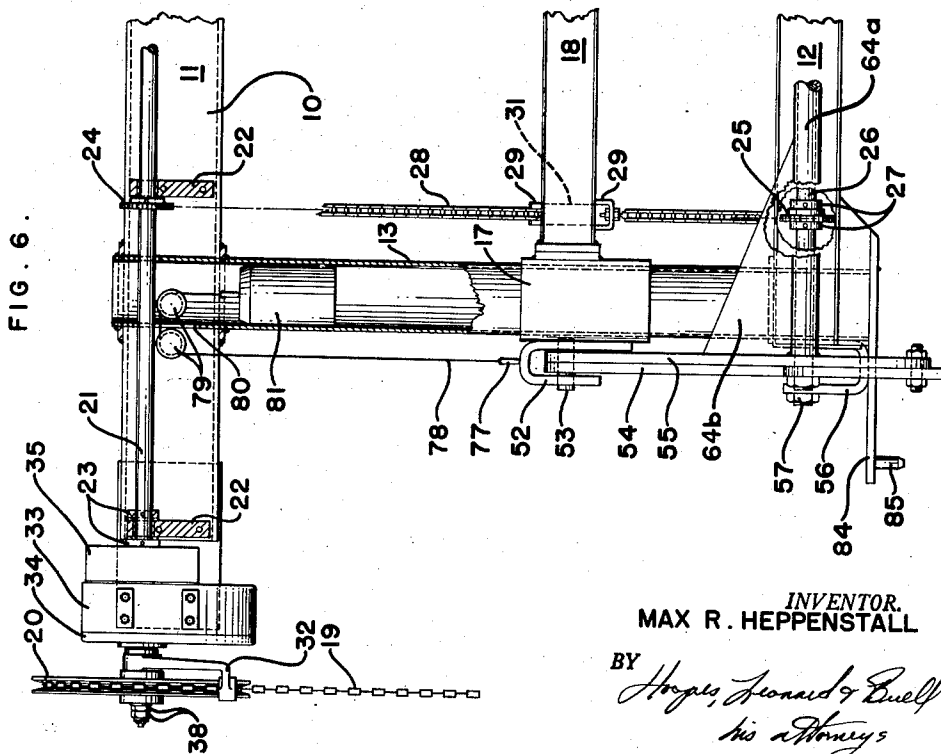
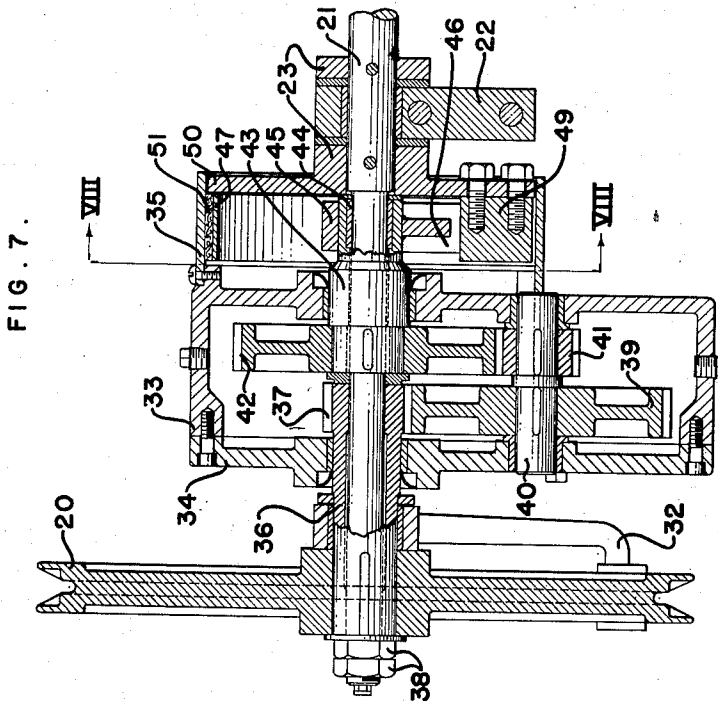
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6 Sheets-Sheet 3



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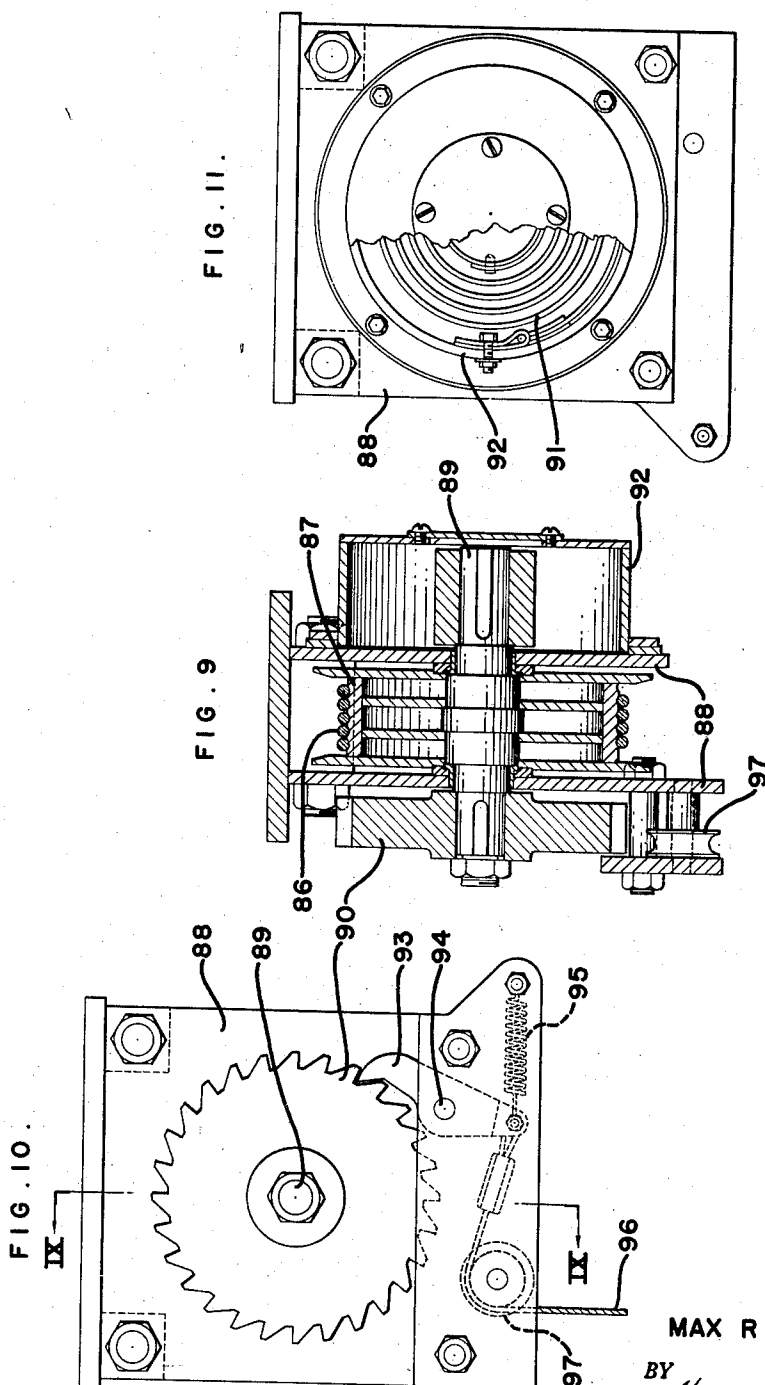
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6 Sheets-Sheet 4



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6 Sheets-Sheet 5

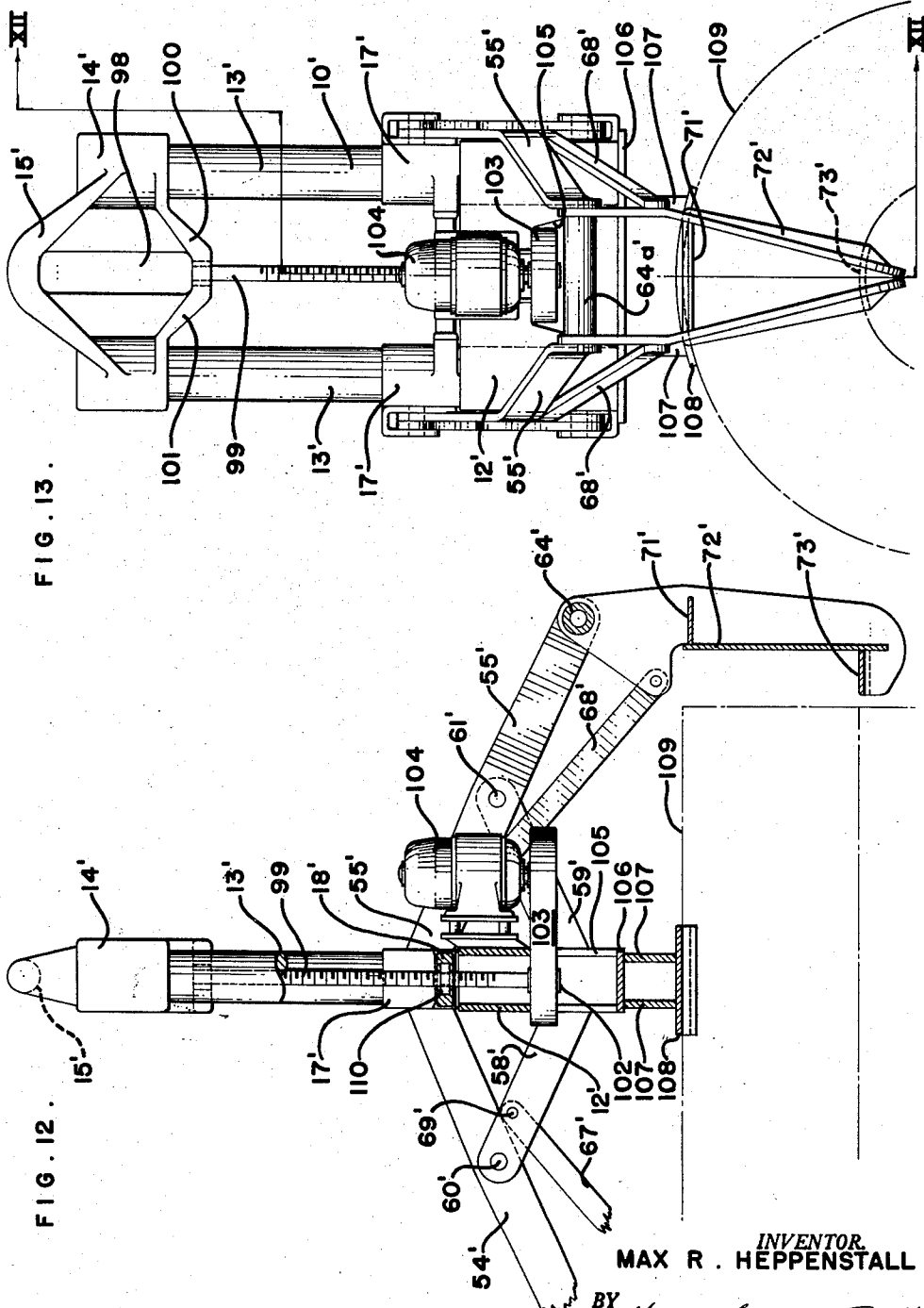


FIG. 13.

FIG. 12.

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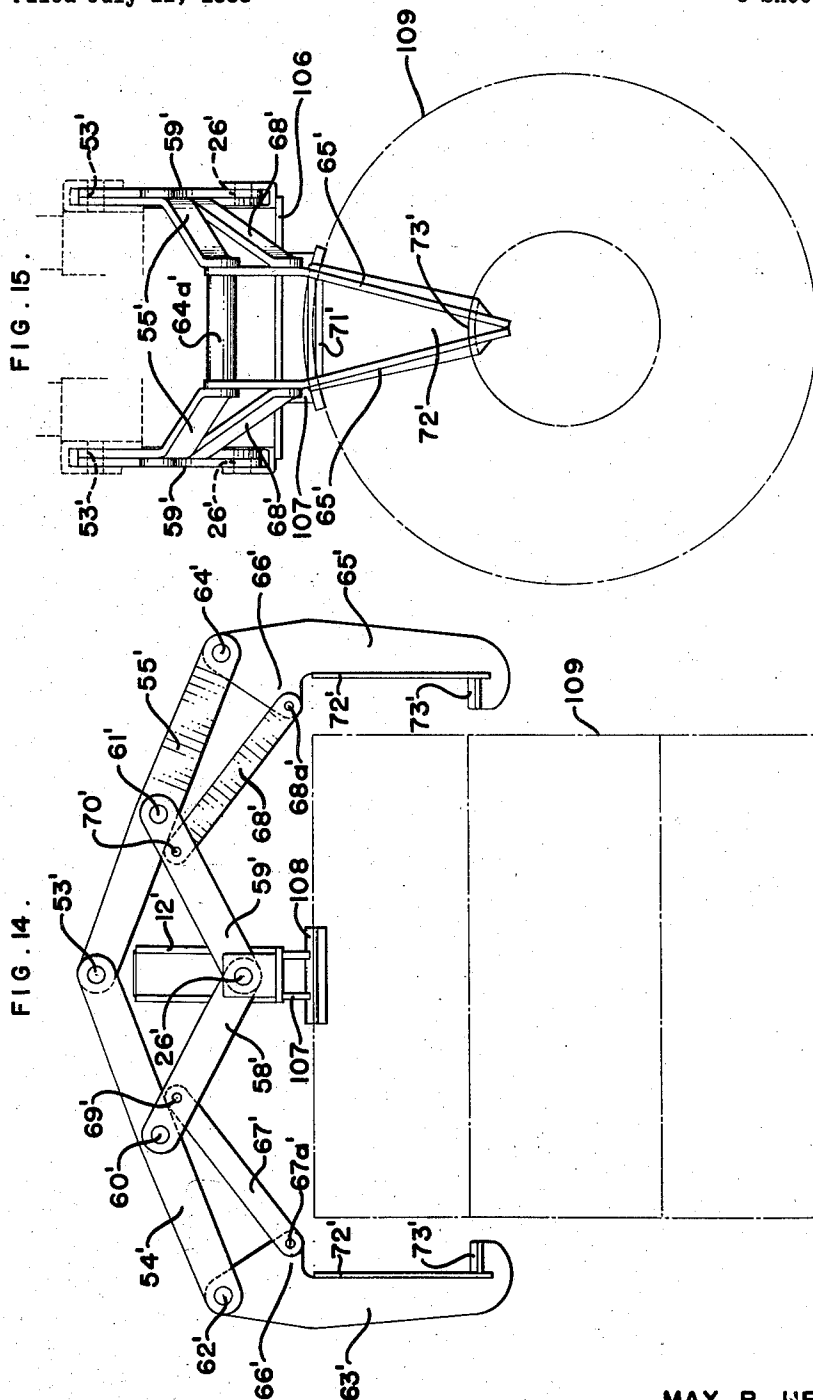
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6 Sheets-Sheet 6



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Application July 11, 1955, Serial No. 521,178

9 Claims. (Cl. 294—67)

This invention relates to lever and link tongs. More particularly, it pertains to tongs of a kind capable of engaging and releasing loads, such as sheets, plates, coils, etc., of varying dimension without significant change in the over-all height of such tongs.

Tongs made in accordance with the principles of this invention include a number of advantages. Thus, a load, such as a pile of sheets or a horizontal coil, may be standing or to be placed on a plant floor with relatively little clearance from other objects and still be subject to respective engagement or release by my tongs. Further, movement of opposed load engaging arms of such tongs will take place in a relatively straight in and out direction. Thereby, when such a tongs is engaged, for example, with a crane hook, it will not be necessary to raise or lower the crane to accommodate changes in the distance between such load engaging arms. Moreover, in embodiments of my device, forces are balanced and loads are centrally supported when being lifted or deposited. Still further, my tongs does not tend to squeeze or damage its loads and the weight of any such load will not force such tongs open.

Other objects and advantages of the invention will be apparent from the following description and from the accompanying drawings, which are illustrative only, in which

Figure 1 is a front view of one embodiment of my tongs in relatively open position;

Figure 2 is a view similar to Figure 1 with such tongs in intermediate position;

Figure 3 is a view similar to Figure 1 with such tongs in relatively closed position;

Figure 4 is a view in elevation looking at the left-hand side of the embodiment of my tongs shown in Figure 1 with the forward end grab subassembly shown, in part only, in operative position by dotted lines;

Figure 5 is a view of the embodiment shown in Figure 4 taken along line V—V thereof with the load engaging arms out of contact with a load;

Figure 6 is a detail view, partly in section, of the upper forward end of the embodiment of my tongs shown in Figure 1;

Figure 7 is a detail view along line VII—VII of Figure 2 through the coupling subassembly for the drive shaft utilized in the illustrated embodiment;

Figure 8 is a view taken along line VIII—VIII of Figure 7;

Figure 9 is a view in section of an end grab subassembly taken along line IX—IX of Figure 4 or 10;

Figure 10 is a detail view of the left side of the subassembly shown in Figure 9;

Figure 11 is a view of the right side of the subassembly shown in Figure 9 with part of the cover removed;

Figure 12 is a front view, in part taken along line XII—XII of Figure 13, of a further embodiment of this invention suitable for motorized utilization with horizontal coils;

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Figure 13 is a side view of the modification shown in Figure 12;

Figure 14 is a front view of lever and link members of the modification shown in Figure 12; and

5 Figure 15 is a side view of the parts shown in Figure 12.

Referring to Figures 1 to 11 of the drawings, one embodiment of my invention may comprise a tongs suitable, for example, for lifting sheets, plates, slabs and other such objects. In such an embodiment, a frame 10 may be provided which is inclusive of a longitudinally extending upper beam 11, a longitudinally extending lower beam 12 and a pair of vertical tubular guides 13. Beams 11 and 12 may be made of built-up section utilizing channels or plates or other standard structural shapes between which guides 13 may pass before the upper and lower ends respectively of such guides 13 are welded to components of the respective beams 11 and 12, as depicted in part in Figure 6.

A crane hook eye 14 may be rigidly affixed to beam 11 and comprise spaced upstanding side plates connected at the upper ends by a bolt on which a grooved crane hook spool 15 is journaled for engagement, for example, by a crane hook 16 as shown in dotted outline in Figure 4. Hook eye 14 is centrally located relative to my tongs construction and upon any raising or lowering thereof by crane hook 16, any load supported by my tongs will move correspondingly without the tongs tending to tip or tilt detrimentally in performing its load-carrying function.

Guides 13 are longitudinally spaced a desired distance as shown in Figure 4. On each guide 13, a relatively closely fitting sleeve 17 is adapted to slide. Those sleeves 17 are rigidly connected by a tie beam 18 bolted to each thereof at the ends of such tie beam. Hence, as tie beam 18 is raised or lowered in the illustrated embodiment, sleeves 17 correspondingly move up and down on guides 13 in a manner and for purposes herein described. The members movable on guides 13, including sleeves 17 and beam 18, in effect constitute a longitudinally extending movable crosshead. That crosshead 17—18 is adjusted to its proper height on guides 13, in the illustrated embodiment, by pulling in whatever direction is desired upon a hand chain 19 at the forward end of my tongs.

Hand chain 19 is reeved over the top of a sheave 20 loosely mounted upon the forward end of a drive shaft 21. Drive shaft 21 extends longitudinally through the center of beam 11 and through suitable openings in guides 13. Brackets 22 affixed to beam 11 provide bearings for shaft 21 and collars such as those marked 23 prevent axial movement of shaft 21 while permitting rotation thereof to take place. A pair of drive sprockets 24 are keyed to shaft 21 above the respective ends of tie beam 18 in the relative positions indicated in Figures 4 and 6.

A pair of idler sprockets 25 are free on a non-rotating idler rod 26, collars 27 being utilized to keep each idler sprocket 25 in vertical planar registry with its corresponding drive sprocket 24. A chain 28 such as a roller chain extends around each pair of sprockets in meshing engagement therewith as illustrated in Figures 5 and 6. The ends of each chain 28 are respectively affixed to anchors 29 which in turn are secured to tie beam 18. The other reach 30 of each chain 28 extends continuously between each pair of sprockets 24—25. A guard plate 31 insures movement of reach 30 past tie beam 18 during adjustment of crosshead 17—18 without catching.

In effect therefore, each drive chain 28 is an endless chain to which tie beam 18 and crosshead 17—18 is affixed at one point on one of the vertical reaches of each chain 28 with the result that as drive shaft 21 is rotated in either direction by chain 19, crosshead 17—18 will move either up or down, as the case may be, on guides 13 between beams 11 and 12. In the illustrated

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embodiment, a rotation of shaft 21 in a clockwise direction as viewed in Figure 5 will lower crosshead 17—18 and move the tongs in an opening direction. Conversely, rotation of shaft 21 in a counterclockwise direction will raise crosshead 17—18 and move the tongs embodiment in a closing direction. A fork retainer 32 hangs on the forward extension of shaft 21 to keep hand chain 19 from intertwining as shown in Figure 2.

A coupling mechanism is utilized in the illustrated embodiment for the turning of drive shaft 21 by means of hand chain 19. The forward end of beam 11 supports in fixed relation thereto a gear case 33 having a cover 34 bolted thereto. A brake drum 35 of an internal expanding character is secured to the other side of casing 33. If it is desired to rotate shaft 21 either to engage a load before a crane hook 16 is raised to lift the load by means of my tongs and carry it to another location, or lift it in place, or if it is desired to release a load after crane hook 16 has deposited a load carried by the illustrated embodiment of my tongs, chain 19 is pulled in the appropriate direction thereby rotating sheave 20. Sheave 20 in turn is keyed to a hub 36 of a drive pinion 37. The center of hub 36 and its integral pinion 37 are hollow and fit over the front end of drive shaft 21 on which they are freely mounted, nuts 38 being utilized to keep the subassembly in assembled relation. The retainer 32 previously mentioned is free on hub 36 and that hub extends through an appropriate seal and bushing in cover 34.

As sheave 20 is rotated, pinion 37 rotates an idler gear 39 mounted on a stub shaft 40 in casing 33. Gear 39 is keyed to shaft 40 as is an idler pinion 41 so that rotation of gear 39 also rotates pinion 41 which in turn rotates a drive gear 42. Drive gear 42 is keyed to a hollow arbor 43 but not to drive shaft 21. Bushings 44 are provided between the bore of arbor 43 and shaft 21. Arbor 43 extends through a suitable opening in the back of casing 33 where it also is bushed and a seal provided so that the interior of casing 33 may have oil kept therein to lubricate the rotating parts. The rear end of arbor 43 is affixed to a drive arm 45 which in the illustrated embodiment is bifurcated and generally of a horseshoe shape in the illustrated embodiment as shown in Figure 8.

An intermediate web connects the sides 46 of arm 45 to transmit force in whatever direction sheave 20 is turned by manipulation of hand chain 19. Inside drum 35 there is a split brake band 47 which is not affixed to the subassembly. Brake band 47 has radially inwardly turned spaced ends 48, said spacing not only being from each other but also from the inside of each of the respective sides 46 of arm 45 and from the sides of a block 49. Block 49 in turn is bolted to a drive plate 50 which is integral with the forwardmost collar 23 keyed to shaft 21. A brake lining 51 is generally affixed to brake band 47 and the temper and tension in brake band 47 is such that, upon making the subassembly, it causes lining 51 to press lightly against the inside or braking surface of drum 35.

In operation, the coupling subassembly shown in Figures 7 and 8 thereby acts so that when sheave 20 is turned by chain 19, in either direction, the corresponding side 46 of drive arm 45 will move against the adjacent end 48 of brake band 47 to urge it toward block 49. Thereby, the brake band is pulled by drive arm 45 tending to contract band 47 in diameter and the side 46 of drive arm 45 approaching block 49 will engage it in a solid contact relation to move block 49 and thereby drive plate 50 and turn drive shaft 21 in a direction corresponding to the rotation of sheave 20 without hindrance or braking between lining 51 and drum 35.

Although in the illustrated embodiment the balance of forces in my construction is such that when a load is being carried by my tongs, the weight of that load will not free itself from the tongs, an added safety precaution is included by virtue of the subassembly shown in Figure 7. Thus, any force imposed on shaft 21 to rotate

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it except a force transmitted through sheave 20 and drive arm 45, will have the following locking effect safeguarding against movement or slippage. Thus, if shaft 21 should try to turn drive arm 45, block 49 would tend to try to move toward one of the sides 46 of drive arm 45 and in so doing would push the interposed end 48 of brake band 47 thereby expanding that band and forcing brake lining 51 into frictional braked engagement with the internal braking surface of drum 35. It will thus be seen that the coupling subassembly of Figure 7 is a one-way coupling operative by pulling chain 19 but inoperative to permit the shaft 21 to release itself from any adjustment position to which it may have been moved by such manipulation of hand chain 19. Thereby, chain 19 and sheave 20 can be utilized to rotate drive shaft 21 but a force exerted on shaft 21 cannot rotate sheave 20 and chain 19. Hence, when my tongs is in load-engaging relation with a load, the weight of that load will not cause the tongs to release. Instead, the tongs will carry the load safely and without likelihood of failure not only because of the balanced construction thereof but also because of the added safety factor provided by the coupling subassembly shown in Figures 7 and 8. While the parts illustrated in Figure 7 include an internal expanding brake, those to whom this invention is disclosed will understand that such subassembly may be modified to include externally contracting brake parts without departure from the scope of my invention.

Each sleeve 17 is provided with a pivot housing 52 welded or otherwise affixed to the axially outward side of the respective sleeves 17. A pivot pin 53 extends between the sides of said housings 52, which are of generally inverted U-shape from the side in the illustrated form. Those pivot pins 53 are secured in place for the pivotal support of a pair of right-hand levers 54 and of a pair of left-hand levers 55, one such right-hand and one such left-hand lever being at each end of a crosshead 17—18 in the respective housings 52. The lower ends of the two left-hand levers 55 are rigidly connected together by a rod 64a which in the illustrated embodiment is coincident with the axis of the pivots for that pair of levers 55. The pivots 64 at the respective ends may be threaded reduced portions integral with rod 64a at the extremes thereof. Gusset plates 64b may be welded respectively to pipe 64a and the facing sides of lever 55 as shown in Figure 4 to insure sufficient strength in that portion of the new tongs. Similar provision is made for the rigid connection together of the lower ends of the two rigid hand levers 54 coinciding with axis 62 including, if desired, the provision of gusset plates 62b.

The inner ends of each set of upper levers 54 and 55 are drilled and they may be bushed for such pivotal movement about the pins 53.

In my tongs also, the structure is balanced about a longitudinally extending vertical plane through the axes of drive shaft 21 and an idler tie rod 26 as may be noted from an examination of Figures 1 to 3 and Figure 5. Tie rod 26 projects through openings in the lower ends of the respective guides 13 and across the distance between the sides of lower pivot housings 56. Lower pivot housings 56 are on the axial outward side of guides 13 and beam 12 to which such housings 56 are affixed by welding or otherwise. The rod 26 is secured against axial movement by nuts 57 and passes through registering openings in such sides of the housings 56 at each lower end of frame 10. The pivot housings 56 are generally U-shaped from the side in the illustrated form of my tongs.

The inner ends of a pair of right-hand lower strut members 58 and a pair of left-hand lower strut members 59 are drilled and are pivoted upon tie rod 26 within the respective housings 56, one such member 58 and one such member 59 constituting a set of such members at each end of by tongs. If desired, the holes through the inner ends of members 58 and 59 may be bushed where

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they fit around tie rod 26, the end projections of which act as pivots for such members. Suitable spacing means may also be utilized in connection with the various pivotal connections so that the members retain their positions as assembled.

The upper or outer ends of the respective right-hand compression members 58 are pivotally connected at 60 to the midpoint of the respective levers 54. The upper or outer ends of the left-hand compression members 59 are respectively pivotally connected at 61 to the midpoints of the respective left-hand levers 55. The other or outer ends of the right-hand levers 54 are pivotally connected at 62 to the upper ends of right-hand load lift arms 63, respectively. On the other hand, the outward or lower ends of the left-hand levers 55 are pivotally connected at 64 to the upper ends of the respective left-hand load lift arms 65. Preferably, the distance from the common axis of pivots 53 to axis 60 is the same as the distance from axis 60 to axis 62 and, in addition, is the same as the distance from axis 60 to the common axis of pivot 26. Thereby, isosceles triangles are formed in a preferred embodiment with the variable distance 26 to 53 as the base of one triangle on the one hand and with the inversely variable distance between the axis of rod 26 and the axis of pivot 62 as the base of a second triangle on the other hand.

Inwardly extending rigid plates 66 may be utilized at the upper ends of lift arms 63 and 65 for pivotal connection to the lower ends of connecting links 67 and 68 at 67a and 68a respectively. The upper ends of connecting links 67 and 68 are pivoted at 69 and 70 respectively to the members 58 and 59. The length of the connecting links 67 and 68 is and the respective pivotal connections thereof are placed such relative to the balance of my structure that regardless of the position to which crosshead 17—18 may be moved on guide 13, the right and left-hand lift arms 63 and 65 will be and remain substantially vertical and parallel to one another and to frame 10 during movement. Moreover, the arms 63 and 65 during movement do not shift vertically but remain at the same level in appreciable respects.

Top rails 71 and bottom rails 72 may be used on each side of the illustrated embodiment to join the two right-hand lift arms 63 rigidly together on the one side and likewise to join the two left-hand lift arms 65 rigidly together on the other side. The lower rails 72 may be made of angles with one flange thereof in the form of a projection 72. Such projections on opposite sides of the tongs face inwardly in opposed relation so as to go underneath a stack of steel sheets or plates or slabs or underneath the sides of a pallet. Thus, as schematically illustrated in Figure 5, a stack 74 of steel sheets may be positioned on a supporting base 75 preparatory to being lifted. Upon closing my tongs, projections 73 will slip underneath the bottom of the side edges of stack 74 as crosshead 17—17 is raised by turning sheave 20 in a counterclockwise direction as viewed in Figures 1 to 3. After the tongs is closed, crane hook 16 may be used to lift my tongs and stack 74 for transportation to another location. Conversely, if such stack is deposited on another base, sheave 20 can be rotated in a clockwise direction to open the lift arms 63 and 65 and removing the projections 73 from beneath such edges of stack 74 whereupon the tongs may be lifted away by elevating crane hook 16. Handholds 76 may be provided at the ends of my tongs on the lift arms for precision of positioning while the tongs is suspended from the crane hook or other supporting member.

It will also be seen that regardless of a change in the lateral dimension of the load to be accommodated between the lift arms on each side of my tongs, the adjustment of the height of crosshead 17—18 may be correspondingly made without change in the over-all height of my tongs which, for our purposes here, may be deemed to be the height between hook eye 14 and the projections

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73. Thus, that over-all height is the same whether the illustrated embodiment is in a substantially fully opened position (Fig. 1), in an intermediately opened position (Fig. 2), or is in a substantially fully closed position (Fig. 3). A significant advantage of this construction, therefore, is that the crane or other device supporting my tongs does not have to be raised or lowered to compensate the height variation required in many prior tongs when a new load to be picked up had different dimensions, or simply by virtue of the fact that such prior tongs had to be opened or closed.

With my tongs, faster load pickup and release irrespective of the dimension of the load is possible therefore and is controllable moreover by the man most immediately at the load pickup or deposit location. Still further, embodiments of tongs can work in closer quarters since the clearance need be substantially no more than the thickness of the load lift arm on each side. Once the tongs is over a load, as shown in Figure 5, they are readily closed and the load transferred. In other words, my tongs can work closer to a load and with less space under and around the sides of a load.

Additional balance in my device may be provided in the tongs for the crosshead and the levers and linkages. Thus, as shown in Figures 4 and 6, the housings 52 may be provided with wire rope sockets 77 for one end of wire ropes 78. Each such rope passes up through the center of beam 11 and over a pair of grooved pulleys 79 mounted on such beam at each end, an opening 80 being provided in the nearer side of the respective guides 13 for such purpose. The other end of wire rope 78 is affixed to a suitable counterweight 81 in each guide 13 to slide up and down inversely with movements of crosshead 17—18.

Wherever in this description terms such as "upper or lower," "front or back," "right-hand or left-hand," "vertical or horizontal," "forward or rear," "above or below," "outer or inner," or the like, are utilized it is intended that such terms be deemed to be relative rather than absolute since the instant invention may take many forms and be utilizable in many different positions.

In the lifting of stacks of certain gauges of steel sheets, there may sometimes be a tendency for such a stack to sag or buckle longitudinally between lift arms such as those numbered 63 and 65 in my illustrated embodiment. Any tendency to such sagging or buckling may be overcome to any required extent by the use of end grabs 82 having axially inwardly extending flanges 83. When grabs 82 are not in use, they may be hooked and retained underneath a ledge 84 fixed at the lower front and rear ends of frame 10. Ledge 84 may be provided with a depending pintle 85 to engage a corresponding hole in flange 83.

The end grab subassembly utilized in my illustrated embodiment is best shown in Figures 4 and 9 to 11. The manner of use of the end grab is illustrated in part in dotted lines on the left-hand side of Figure 4 where the balance of the front end grab has been omitted for clarity of presentation of the balance of the construction. A similar end grab subassembly facing an opposite direction is provided at the rear end of the illustrated embodiment as shown.

In each such end grab subassembly, the upper end of the end grab 82 is pivotally affixed to one end of a wire cable 86. The other end of cable 86 is fastened to a reel 87 mounted in supports 88 secured to the underside of the opposite ends of beam 11. Reel 87 is affixed to a short shaft 89 which is keyed at one end to a stop ratchet wheel 90 and at the other end to the inner convolution of a ribbon coil spring 91. The outer end of ribbon coil spring 91 is anchored to the outer wall of a spring casing 92. A pawl 93 is pivotally connected to support 88 at 94 and is biased into engagement position with ratchet wheel 90 by a spring 95. Wire release cord

96 extends up into support 88 and over a pulley 97 to the lower end of pawl 93.

The action of spring 91 normally tends to keep cable 86 wound up on reel 87 where it would hold the rear grab 82 as shown in solid lines in Figure 4. When spring 91 reels in cable 86, wheel 90 and pawl 93 ratchet. However, as each cable 86 is unreeled from its reel 87 against the force of spring 91, release cord must be held to keep pawl 93 out of engagement with the teeth of ratchet wheel 90 until the grab is engaged with the load, as illustrated in the dotted left-hand position in Figure 4. When a grab 82 is in such grabbing engagement with a load, such as stack 74, without any sag therein, releasing the cord 96 will permit pawl 93 to return to engagement with the teeth of wheel 90 and act as a positive stop lock against any involuntary extension of that cable 86. Thereby, when the tongs is lifted, no longitudinal sagging or buckling of the stack can occur, even if there should be such a tendency, because of the inextensible cable 86 holding the respective end grab 82 in engagement with the underside of the front and rear ends of the load.

A further embodiment of my tongs suitable for motorized handling horizontal coils is shown in Figures 12 to 15 in which those parts generally corresponding in character of construction and functioning to parts in the first described embodiment are provided with the same reference numerals with the addition of a prime factor thereto. In this further embodiment, a crane hook eye 14' may be a casting or forging having a bridge 15' above a window 98 through which a crane hook passes. Eye 14' also serves as a beam in the nature of beam 11 to cap front and rear guides 13' to which 14' is rigidly affixed. A crosshead 17'—18' is adapted to slide on guides 13'.

In this further embodiment, a rotatable drive screw 99 is provided parallel to and midway between the guides 13'. The upper end of screw 99 is journaled in a thrust bearing 100 held in the lower reach 101 of eye 14'. The lower end of screw 99 may be square and slidably extends into a square socket 102 so that as socket 102 is rotated by gears in gear reducing casing 103, screw 99 is correspondingly rotated. Some axial movement between screw 99 and socket 102 may be permitted to take care of any relative expansion or contraction. A reversible electric motor 104 when connected to an electric power source by electric extension wiring rotates the gears in casing 103 to turn screw 99 in the desired direction to move crosshead 17'—18' up or down the guides 13' as the case may be.

The casing 103 and motor 104 are affixed to plates 12' forming the lower end of frame 10', the plates 12' being rigidly affixed to the lower ends of guides 13' and extending therebetween. The plates 12' are provided with a recess 105 to accommodate the positioning of casing 103 as shown in Figures 12 and 13. A plate 106 closes the underside of frame 10' and has depending plates 107 welded thereto. An arcuate saddle 108 is in turn welded to the lower edges of depending plates 107, the arcuity of saddle 108 acting as a rest for gauging the positioning of my tongs relative to a horizontal coil 109 as may be seen in Figures 13 to 15.

A driven nut 110 is provided in a drilled opening in tie beam 18', the driven nut being held against rotation or axial movement relative to tie beam 18'. Hence, as screw 99 rotates, nut 110 will force tie beam 18' to move up or down with the sleeves 17' on the guides 13' depending upon the direction of rotation of screw 99 and the position of the crosshead 17'—18' when the motor 104 begins to revolve. It will be understood that limit switches will be employed in the circuit of motor 104 to cut off the power thereto whenever crosshead 17'—18' reaches an extreme position at the top or bottom of guides 13', or when the load arms 63' and 65' have closed against the ends of a horizontal coil such as coil 109, or have opened or closed to their greatest extent possible. The pitch of the screw 99 relative to the pitch of the

female thread in nut 110 is such as to be "irreversible" so that crosshead 17'—18' may only be moved when force is exerted on screw 99 by motor 104.

The functioning of the levers 54' and 55', compression members 58' and 59' and link members 67' and 68' shown in Figures 12 to 15 is similar to that of the corresponding parts in the first-described embodiment of my tongs. However, the right-hand levers 54' and the left-hand levers 55' narrow toward one another as they extend outwardly from frame 10' and such is also the case with links 67' and 68'. Each pair of lift arms 63' and 65' taper downwardly from the top thereof where they are pivotally connected to the lower ends of the upper levers 54' and 55' respectively as shown in Figures 13 and 15. Thereby, the opposed flange projections 73' are small enough to engage the center hole in a horizontal coil which is to be picked up by the motorized further embodiment which is illustrated. A plate 72' may be fixed to the inside of each pair of arms 63' and 65' to provide a flat surface to press against the edges of the coil turns when such a coil is the load to be picked up or deposited in the manner and with advantages inuring to such further embodiment as described in connection with the first above-described embodiment.

Various other embodiments and modifications may be made in aspects of my invention without departing from the spirit thereof or the scope of the appended claims.

I claim:

1. In a tongs, in combination, a frame having spaced rigid vertical guides, a longitudinally extending crosshead movable up and down on said guides, a drive shaft mounted on said frame above said crosshead and connected thereto to move said crosshead up and down on said guides dependent upon the direction of rotation of said drive shaft, reversible means for rotating said drive shaft, a pair of laterally extending levers pivotally connected to said crosshead about a common axis, a pair of strut members extending laterally and pivotally connected to said frame about a common axis, said strut members further being pivotally connected to said levers respectively intermediate the ends of said levers, load arms pivotally connected to said levers, lifting projections on said arms, and links pivotally connecting said arms and said strut members respectively.

2. In a tongs, in combination, a longitudinally extending upper beam, a longitudinally extending lower beam, a pair of spaced rigid vertical guides rigidly interconnected with said beams, said beams and guides comprising a rigid frame, a longitudinally extending crosshead movable up and down on said guides between said beams, means for counterweighting said crosshead, a drive shaft mounted on said upper beam and extending in the direction thereof, a second shaft mounted on said lower beam and extending in the direction thereof, at least one drive sprocket on said drive shaft, at least one driven sprocket on said second shaft in registry with said drive sprocket, a sprocket chain engaging said sprockets, said sprocket chain being affixed to said crosshead to move said crosshead up and down on said guides dependent upon the direction of rotation of said drive shaft, means mounted on said frame for rotating said drive shaft, a pair of downwardly and outwardly extending levers pivotally connected to each outer end of said crosshead about a common axis, said levers at each such end extending to each side of a vertical plane through said frame, a pair of upwardly and outwardly extending strut members pivotally connected to each outer end of said frame about a common axis below said crosshead, the outer ends of said strut members being pivotally connected substantially to the midpoint of said levers respectively, means rigidly connecting each pair of levers on each side of said frame adjacent the outer ends thereof, a pair of substantially vertical load arms on each side of said frame depending from the outer ends of said levers and in pivotal relation thereto, inwardly and longitudinally extending projections ad-

jacent the lower ends of each of said pairs of arms, connecting links pivotally connected at one end adjacent the upper ends of said arms, said links being pivotally connected adjacent their other ends to said strut members respectively to maintain said arms substantially vertical in all positions of said crosshead along said guides, and a lifting eye centrally affixed to said upper beam.

3. In a tongs, in combination, a frame having spaced rigid vertical guides, a longitudinally extending crosshead movable up and down on said guides, a drive shaft mounted on said frame above said crosshead a coupling sub-assembly mounted on said drive shaft having a drive member and a driven member ineffective to turn said drive member, a sheave in said subassembly which may be rotated in either direction to drive said drive shaft in either direction, a brake in said coupling subassembly adapted to lock said drive shaft against movement other than when transmitted through said sheave, means connecting said drive shaft and crosshead in a positive manner to move said crosshead up and down on said guides dependent upon the direction of rotation of said drive shaft, a pair of downwardly and outwardly extending levers pivotally connected to each outer end of said crosshead about a common axis, said levers at each such end extending to each side of a vertical plane through said frame, a pair of upwardly and outwardly extending strut members pivotally connected to each outer end of said frame about a common axis below said crosshead, the outer ends of said strut members being pivotally connected substantially to the midpoint of said levers respectively, a pair of substantially vertical load arms depending from the outer ends of said levers and in pivotal relation thereto, rails connecting each pair of arms on each side of the vertical plane of said frame, inwardly extending projections adjacent the lower ends of each of said pairs of arms, connecting links pivotally connected at one end adjacent the upper ends of said arms, said links being pivotally connected adjacent their other ends to said strut members respectively to maintain said arms substantially vertical in all positions of said crosshead along said guides.

4. In a tongs, in combination, a guide, a sleeve movable on said guide, laterally extending levers pivotally connected to said sleeve, laterally extending compression members pivotally connected to said guide, said members further being pivotally connected to said levers respectively intermediate the ends of said levers, load arms to each side of said guide pivotally connected to said levers, link means for connecting said members and load arms to maintain said load arms substantially parallel to each other and to said guide, and means for adjusting and fixing the position of said sleeve along said guide.

5. In a tongs, in combination, a guide, a sleeve movable on said guide, right-hand and left-hand levers pivotally connected to said sleeve, right-hand and left-hand members pivotally connected to said guide, said members extending towards said levers and respectively pivotally connected thereto, right-hand and left-hand opposed load support arms pivotally connected to said levers, right-hand and left-hand links extending between and pivotally engaging said arms and said members respectively, and means connected to said guide for varying the position of said sleeve along said guide.

6. In a tongs, in combination, a guide, a sleeve movable on said guide, outwardly and downwardly laterally extending levers having a common pivotal axis connected to said sleeve, upwardly and outwardly laterally extending compression members having a common pivotal connection to said guide, said members being pivotally connected to said levers respectively intermediate the ends of said levers, load arms to each side of said guide pivotally connected to the lower ends of said levers, said load arms being in opposed relation to each other, laterally extending links pivotally connected adjacent one end to said compression members and pivotally connected adjacent their other end to said load arms respectively,

and means for varying the position of said sleeve along said guide to move said load arms substantially parallel and substantially without movement of said load arms in an axial direction relative to the axis of said guide.

7. In a tongs, in combination, a guide, a sleeve movable on said guide, outwardly and downwardly laterally extending levers having a common pivotal axis connected to said sleeve, upwardly and outwardly laterally extending compression members having a common pivotal connection to said guide, said members being pivotally connected to said levers respectively intermediate the ends of said levers, the distance between the common pivotal axis of said levers and the pivotal connection between said levers and said members being substantially the same distance as the distance between said last-mentioned pivotal connection and the axis of the pivotal connection of said members to said guide respectively, load arms to each side of said guide pivotally connected to the lower ends of said levers, said load arms being in opposed relation to each other, the distance between the axis of the pivotal connection of said members to said guide and the pivotal connection between said levers and members being substantially the same distance as the distance between said last-mentioned pivotal connection and the pivotal connection of said levers to said load arms respectively, laterally extending links pivotally connected adjacent one end to said compression members and pivotally connected adjacent their other end to said load arms respectively, and means for varying the position of said sleeve along said guide to move said load arms substantially parallel and substantially without movement of said load arms in an axial direction relative to the axis of said guide.

8. In a tongs, in combination, a vertical guide, a crosshead movable on said guide, a drive screw positioned parallel to said guide, means for mounting said drive screw for rotational movement only relative to said guide, a nut connected to said crosshead to engage said drive screw and move said crosshead up and down in accordance with the direction of rotation of said drive screw, reversible means connected to said guide to rotate said drive screw, laterally extending levers pivotally connected to said crosshead, laterally extending strut members pivotally connected to said guide and to said levers respectively, load arms pivotally connected to said levers, said load arms tapering substantially to a point, lifting projections affixed to said respective load arms adjacent the lower ends thereof, and links pivotally connected to said strut members and to said load arms to operate said load arms during up and down movements of said crosshead.

9. In a tongs, in combination, a frame including vertical guides, a crosshead movable on said guides, a drive screw positioned parallel to and between said guides, means for mounting said drive screw for rotational movement only relative to said frame, a nut engaging said drive screw, said nut being connected to said crosshead to move said crosshead up and down in accordance with the direction of the rotation of said drive screw, a reversible electric motor mounted on said frame to turn said drive screw, downwardly and outwardly laterally extending levers pivotally connected to the outward ends of said crosshead about a common axis, outwardly and upwardly extending compression members pivotally connected to the lower part of said frame on the outer ends thereof about a common axis, said compression members further being pivotally connected to the middle of said levers, depending load arms pivotally connected to the outer ends of said levers, said load arms on each side of said tongs tapering substantially to a point, opposed lifting projections affixed to said respective load arms at the lower ends thereof, links pivotally connected to said compression members and to said load arms to maintain said load arms substantially parallel during up and down movements of said crosshead, and a depending saddle

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connected to the underside of said frame, whereby horizontally positioned coils may readily be engaged and lifted by said tongs.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,857,193

October 21, 1958

Max R. Heppenstall

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 28, for "deterimentally" read -- detrimentally --; column 4, line 74, for "by tongs" read -- my tongs --; column 5, line 48, for "projection 72" read -- projection 73 --; line 56, for "crosshead 17-17" read -- crosshead 17-18 --; line 71, and column 6, lines 20 and 21, for "my tons" read -- my tongs --; column 6, line 36, for "lower," read -- lower," --.

Signed and sealed this 24th day of March 1959.

(SEAL)

Attest:

KARL H. AXLINE
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