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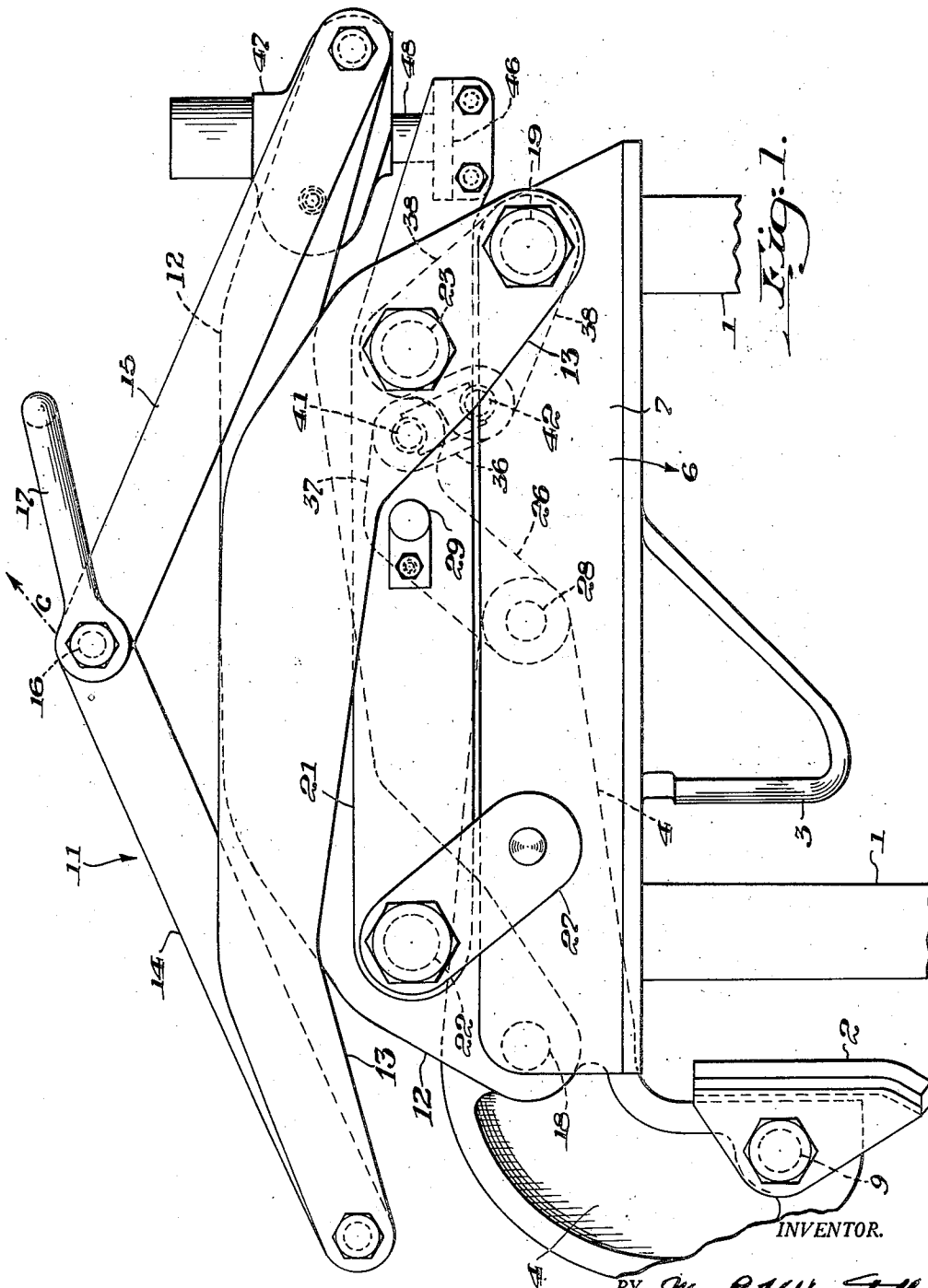
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2,536,932

LIFTING TONGS

Filed Sept. 9, 1949

2 Sheets-Sheet 1



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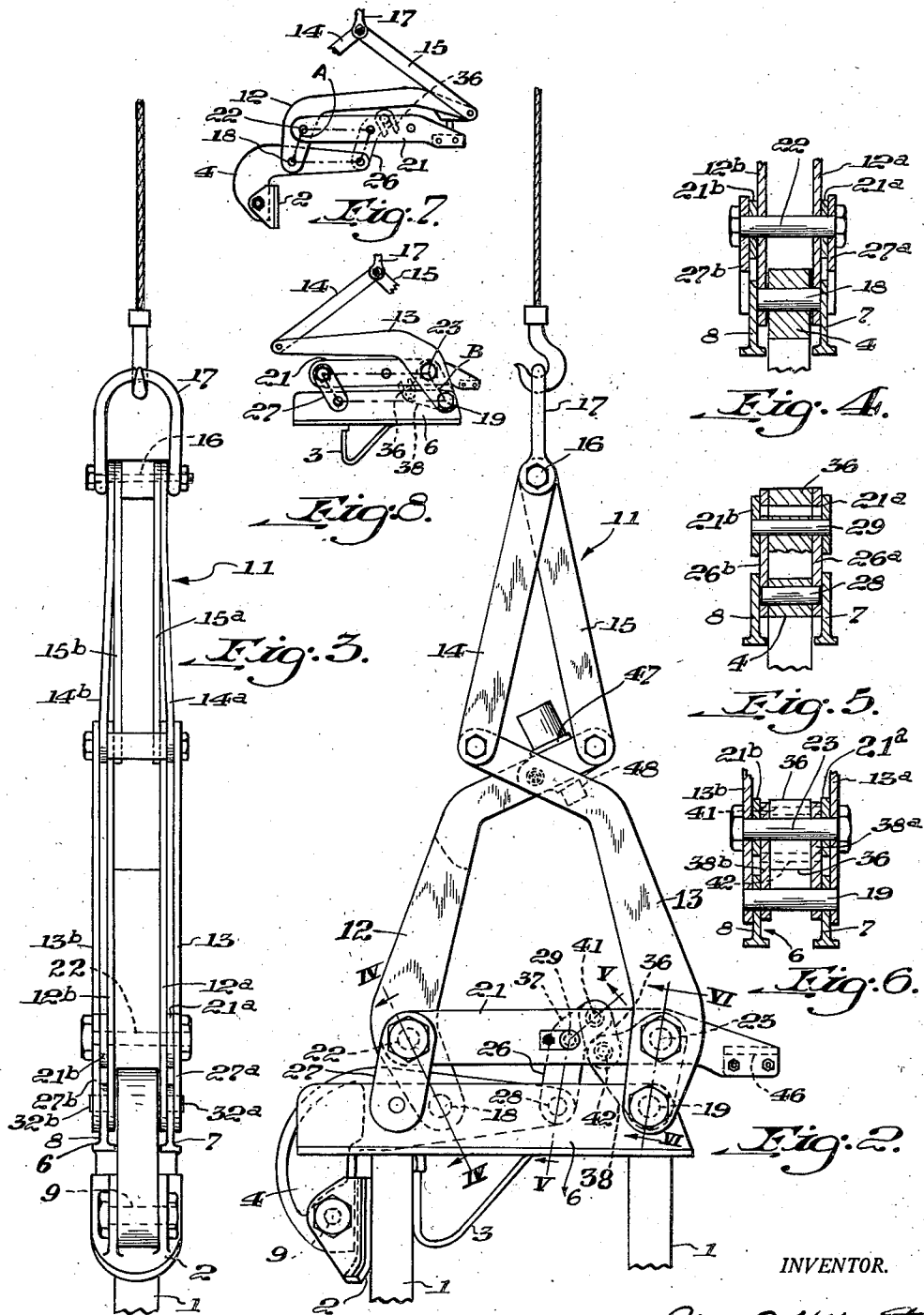
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,536,932

LIFTING TONGS

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8 Claims. (Cl. 294—106)

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This invention relates to lifting tongs of the type commonly used to lift and transfer material, such as coils of steel strip, ingots, etc., from place to place in a mill.

Tongs of this type generally include a pair of load-grappling, shoe-bearing arms carried by a toggle, or the like, the arrangement being such that, when the toggle is lifted, the shoes move towards each other to grip and lift the load and, when the load is deposited, the shoes spread apart to release it. To hold the arms in such a spread position, a number of tongs are provided with latching mechanism, such as the mechanism disclosed in my United States Patent 1,839,389, that locks the gripper arms open and permits the tongs to be lifted free of the load, and in addition, holds the arms in their spread-apart position as the tongs are lowered into a load-grIPPING position.

A number of these tongs, however, are not as satisfactory as could be desired either due to structural weaknesses which result in breakage, or because, under certain conditions, they grip the load imperfectly. To assure a solid, secure gripping of the load by the shoes of the tongs, it is desirable to mount the shoe arms in such a way that any lifting force on the tongs, whether it is vertically upward or at an angle to the vertical, exerts an equal force on both of the shoe arms and, thus, coordinates the movement of the arms toward each other into load-grIPPING position. Although such co-ordinated movement has been attempted, nevertheless the mechanism used for effecting it has not been sufficiently strong to sustain any substantial load. Consequently, considerable breakage results, such breakage being particularly frequent in tongs which also include the arm latching feature described above.

It is among the objects of the present invention to provide lifting tongs in which the movement of the shoe arms is co-ordinated to assure a secure gripping of the load to be lifted, and, also, in which such co-ordination is effected by means capable of sustaining heavy loads.

Further objects are to simplify and strengthen the construction of tongs having such co-ordinated movement and to include in the construction latching means for holding the shoe-arms in a spread-apart position.

Although a full description of the invention will be given, its substance resides in forming the structural members into a pair of parallelograms which are connected together by a strong link, the linkage causing the legs of the

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parallelograms to move in unison. The lower leg of each parallelogram carries a shoe member for gripping the load to be lifted, and each of these lower legs is pivotally suspended from a toggle which, when engaged and lifted by a crane, or the like, causes the lower legs to move towards each other. Thus, regardless of the direction of the pull of the crane on the toggle, the force tending to move each lower leg is substantially equal because of the linkage connecting the two parallelograms of which each is a part.

The preferred embodiment of the invention is illustrated in the accompanying drawings of which Fig. 1 is a side elevation of the tongs showing their grappling arms in a spread or open position; Fig. 2 is a view similar to Fig. 1 showing the arms in a closed, grappling position; Fig. 3 a left-hand end view of the tongs as shown in Fig. 2; Figs. 4, 5 and 6 sections taken on line IV—IV, V—V and VI—VI, respectively, of Fig. 2; and Figs. 7 and 8 rather diagrammatic side elevations, these two views taken together being analogous to a single exploded view of Fig. 1 in that each view shows one of the grappling arms and the functional members for supporting and moving it.

Referring to the drawings, the tongs illustrated are formed, particularly, for gripping and transporting coils of steel strip, such as coil 1, the coil gripping members being shoes 2 and 3 each carried by separate grappling arms 4 and 6. Arm 6, as shown in Fig. 3, is formed of a pair of horizontally extending angle members 7 and 8 to the bottom surface of both of which is integrally secured shoe 3. Further, shoe 3 is positioned toward the center of arm 6 and the bottoms of the angles lie in a horizontal plane to provide a level surface on which the tongs rest when set on a coil as shown in Figs. 1 and 2. Arm 4, on the other hand, is a relatively wide bar slidably fitted between the two angles of arm 6, the left-hand end portion of arm 4 (Figs. 1 and 2) being bent downwardly and loosely carrying, on pin 9, shoe member 2.

Both of the shoe-carrying arms are pivotally carried and moved by a toggle 11 which has pairs of lower and upper links 12, 13, and 14, 15, respectively, the upper links being hung at a central point on a king pin 16 that also mounts a bail, or clevis, 17 by which the tongs are lifted. In the preferred structure (Fig. 3), each pair of toggle links includes spaced front and rear members, these being 12a, 12b, 13a, 13b and 14a, 14b, 15a, 15b. The pivotal connection between the

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lower toggle links and the shoe-carrying arms are on pins 18 and 19, pin 18 (Figs. 4 and 7) extending through left-hand arm 4 and being pivotally supported in the front and rear members 12a, 12b of lower link 12; while pin 19 (Figs. 6 and 8) extends through angles 7 and 8 of arm 6 and is mounted in members 13a, 13b of lower link 13, these links 12a, 13b being disposed adjacent to and exteriorly of angles 7 and 8.

Further, lower links 12 and 13 are pivotally connected at points above pins 18 and 19 to another horizontal bar 21. Bar 21, also, is formed of spaced front and rear bar members 21a, 21b that extend adjacent to the front and rear members of lower links 12 and 13 of the toggle, these bar members being disposed exteriorly of link 12 at their left-hand ends (Fig. 3), and interiorly of link 13 at their right-hand ends (Fig. 6). The connections of links 12 and 13 to bar members 21a and 21b are made by pins 22, 23, pin 22 (Fig. 4) being mounted at its ends in the front and rear members of horizontal bar 21 and extending transversely through front and rear members 12a, 12b of link 12. Similarly, at the right-hand end of the tongs, pin 23 (Fig. 6) is carried at its ends in the front and rear members of bar 21 and extends through front and rear members 13a, 13b of link 13.

With the connections described so far, it will be apparent that any upward movement of the toggle by a pull exerted on bail 17 would act to pivot lower links 12 and 13 on their pins 22 and 23, and, since the outer ends of these links are connected to arms 4 and 6, also, would move these arms toward each other. In effect, pins 22 and 23 act as fulcrum points, about which links 12 and 13 pivot, to produce the arm movement. It will be appreciated, however, that links 12 and 13 support only the outer ends of arms 4 and 6. To support the inner ends of each of these arms, short, vertically-inclined links 26 and 27 are provided, link 26 being formed of front and rear members 26a, 26b (Fig. 5) that, at their lower ends, bracket the inner end of arm 4 and are pivotally connected thereto by a transverse pivot pin 28. Near their upper ends link members 26a, 26b extend interiorly of and adjacent to bar members 21a, 21b, and are pivoted to these bar members on another pivot pin 29.

Link 27, which supports the left-hand end of shoe-carrying arm 6, also is formed of front and rear link members 27a, 27b (Fig. 3), these members extending at their upper ends adjacent to and outwardly of bar 21, and, at their lower ends adjacent to and outwardly of angles 7 and 8 of arm 6. Further, at its upper end, link 27 is mounted on pin 22 to form a pivotal connection between link 27 and bar 21. At its lower end, link 27 is pivotally connected to arm 6 by means of short studs 32a, 32b.

From the above, it now should be noted that the outer and inner ends of both horizontal arms are connected to horizontal bar 21 in such a manner that a pair of parallelograms are formed, these parallelograms being indicated by the dot and dash lines of Figs. 7 and 8. As there seen, the left-hand parallelogram (Fig. 7) is formed of arm 4, bar 21, link 26 and the portion of toggle link 12 that lies between fulcrum pin 22 and pin 18, this portion being designated by the letter "A." Similarly, the right-hand parallelogram (Fig. 8) is formed of arm 6, bar 21, link 27 and a portion B of link 13. Of course, to form parallelograms it is necessary that the opposite legs be equal and parallel and this is accomplished by

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disposing all of the upper as well as the lower, pivotal axes of the members of both parallelograms on the same horizontal planes.

Consequently, when there is a direct upward pull on the parallelograms, exerted by a pull on bail 17, the lower legs of the parallelograms, which are arms 4 and 6, move toward each other in horizontal directions and, eventually, close upon a coil placed between them. The important thing, however, is that, as can be noted most clearly in Figs. 7 and 8, each parallelogram can be swung by itself, and the swinging of either one would not necessarily cause movement of the other. Therefore, even when the elements of Figs. 7 and 8 are combined to form tongs, the result, nevertheless, is that the parallelograms can swing independently. As a result, although arms 4 and 6 would move in horizontal planes, there is no guarantee that they would move together in the same horizontal plane. By way of example, if the lifting force were at an angle to the vertical, as most often is the case when a crane is used, more force would be exerted on one arm to move it than on the other and, consequently, more movement would be produced in that one arm than in the other. Therefore, at the instant in which the shoes gripped the coil, the effective gripping force of one shoe would be applied to the coil above or below the effective gripping force of the other shoe. Such would result in an insecure, and unsafe grip and, also, in a grip that would tend to tilt the coil as it is raised into mid-air.

To prevent such insecure gripping, the tongs of the present invention are provided with means to cause an equal, horizontally-directed force to be applied to each shoe-arm, regardless of the direction of the pull of the crane upon the tongs, the particular means employed being a freely-swinging connecting link 36 that ties together the two parallelograms. Preferably (Figs. 7 and 8), link 36 ties vertically-inclined link, or leg, 26 of the left-hand parallelogram to portion, or leg, B of the right-hand parallelogram, it being apparent that these two legs lie rather closely together in the assembled tongs. However, other parallelogram legs could be tied together to accomplish the desired action and, also, the particular arrangement of link members used to achieve the tie possibly could be accomplished in other ways than that to be described.

In the particular arrangement shown, link 26 is specially formed to facilitate its connection by being provided with outwardly projecting portion 37 (Figs. 1 and 2). Also, portion B, which is the portion of lower toggle link 13 lying between pivot pins 23 and 19 is adapted to be interconnected by mounting a somewhat triangular link 38 on pins 23 and 19, this link having identically shaped front and rear members 38a and 38b (Fig. 6) disposed in a spaced relation between the front and rear members of bar 21. Also, triangular link 38 has a portion projecting toward portion 37 of link 26, this portion, as well as portion 37 being provided with openings which receive pins 41 and 42 on which connecting link 36 is mounted.

With the two parallelograms so tied together, it should now be noted that any force tending to move, or swing, either one of them would be translated through link 36 to the other to exert a substantially equal moving force on the other. For example, should the tongs be lifted in the direction of arrow C, Fig. 1, instead of in a vertical direction, more force might be exerted on arm 6 than on arm 4, but, since any movement of arm 6 produces an opposite movement of

arm 4, the forces tending to move the arms together are equalized. The result is that the arms tend to move equal distances toward each other to grip the load, so that, when the load is gripped, the effective gripping force of both arms is directed in the same horizontal plane. Stated in another way, no matter in which direction the load lifting force is applied, vertically-inclined links 26 and 27 swing through the same arcs to maintain the arms in the same horizontal plane throughout their movement.

As mentioned above, the invention also contemplates the use of latching mechanism to hold the shoe-arms in a spread-apart position, both to free the tongs from the load and to allow the tong shoes to be placed around another load. Further, as will become apparent, the interconnected parallelogram arrangement already described is of particular advantage in assisting the latching mechanism to hold the arms rigidly in their spread-apart position.

For a detailed disclosure of the latching mechanism illustrated, reference can be made to my United States Patent 1,839,389. Briefly, it is a two-part mechanism, one part being a keeper member 46 (Fig. 1) carried at the right-hand end of bar 21, and the other a sleeve 47, mounted on toggle link 12 of the tongs, the sleeve mounting a vertically reciprocable and rotatable plunger 48 provided with an enlarged head portion. In operation, after the tongs have gripped and transported a load, and, when they have been lowered to deposit the load at the desired location, the toggles collapse causing plunger 48 to enter keeper member 46. However, as the plunger enters the keeper member, certain cams (not shown) formed interiorly of sleeve 47, effect a rotation of the plunger which locks the members together. Consequently, the tongs can be lifted clear of the deposited load and moved on to pick up another load. To pick up the new load, the tongs, with their shoe-arms spread and locked apart, are lowered onto the load, but, in settling on the load, plunger 48 again is rotated so as to permit it to withdraw from the keeper when the tongs again are lifted. Consequently, the tongs can move together upon the next lift, to grip the load.

In the present tongs, the tying together of the parallelograms assists the latching mechanism in that it assures that both shoe-arms will be rigidly locked in their spread-apart position. The need for locking both arms can be more readily appreciated if it be assumed that the parallelograms were not tied together by link 36, since, if such were the case, only arm 4 would be locked, while arm 6 and toggle link 13 would be relatively free to swing. Such free-swinging of arm 6 would defeat the purpose of the latch, particularly when it is desired to lower the tongs onto a new load with their shoe-arms spread apart, since, in that event, arm 6 could swing inwardly to such a position that its shoe would not fit around the load. However, when arms 4 and 6 are tied together by link 36, the locking-down of arm 4 also locks arm 6 so that both arms are rigidly held apart.

A further advantage of tying the two arms together by link 36 is that the link can be made sufficiently strong to support a substantial portion of the load for which the tong is designed. In this regard, it sometimes happens that considerable load is placed upon link 36, particularly, when the tongs are being lifted free of a deposited load with their shoe-arms locked apart.

In such case, if the coil is nearly as wide as the space between the fully spread-apart shoes, the shoes may catch on the coil, thereby causing the weight of the coil to be borne by the tongs and, particularly, by link 36. However, by using a sufficiently heavy and strong link, the possibility of breakage is practically avoided.

From the above description it is believed that the manner in which the tongs pick up, transport and deposit their loads should be clear, particularly, since the general operation of these tongs is similar to many others now in use. However, the present tongs have a number of advantages over the others since they assure a perfect gripping of the load as well as improve the arm locking mechanism. Further, the structural arrangement is such that the tongs can be manufactured economically from a few parts and, nevertheless, be unusually strong and safe to use.

According to the provisions of the patent statutes, I have explained the principle, preferred embodiment and mode of operation of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. Lifting tongs comprising a pair of grappling arms each having a horizontal section, a horizontal bar disposed above said arms, a pair of load-supporting toggle links each connected to one of said arms for moving the arms toward and away from each other, a pair of parallel vertically inclined links pivotally connecting each of said arms to said bar, one of said vertically inclined links of each of said pairs being formed by the lower ends of said toggle links and said bar and arm-connecting links forming with said bar and arms a pair of parallelograms, and a link connecting together said parallelograms for effecting simultaneous movement of said grappling arms.

2. Lifting tongs comprising a pair of grappling arms each having a horizontal section, load-supporting toggle links having lower members pivotally connected at their lower ends one to each of said arms, a horizontally disposed bar extending above said arms and pivotally connected at spaced points to each of said lower toggle links, two tie links each pivotally connected at its upper end to said bar and pivotally connected at their lower ends one to each of said grappling arms, said bar forming with each of said arms parallel legs of a parallelogram whose other parallel legs are one of said tie links and the lower portion of the lower member of one of said toggle links, and a link connecting together said parallelograms for effecting simultaneous movement of said grappling arms.

3. Lifting tongs comprising a pair of grappling arms each having a horizontal section, load-supporting toggle links having lower members pivotally connected at their lower ends one to each of said arms, a horizontally disposed bar extending above said arms and pivotally connected at spaced points to each of said lower toggle links, two tie links each pivotally connected at its upper end to said bar and pivotally connected at their lower ends one to each of said grappling arms, the pivotal axes of said toggle links and said tie links being disposed in the same horizontal plane both in said bar and grappling

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arms whereby said arms, bar, toggle and tie links form a pair of parallelograms, and a freely-swinging link connecting said parallelogram for effecting simultaneous movement of said grappling arms.

4. Lifting tongs comprising a pair of grappling arms each having a horizontal section, load-supporting toggle links having lower members pivotally connected at their lower ends one to each of said arms, a horizontally disposed bar extending above said arms and pivotally connected at spaced points to each of said lower toggle links, two tie links each pivotally connected at its upper end to said bar and pivotally connected at their lower ends one to each of said grappling arms, said bar forming with each of said arms parallel legs of a parallelogram whose other parallel legs are one of said tie links and the lower portion of the lower member of one of said toggle links, a freely-swinging link connecting together said parallelograms for effecting simultaneous movement of said grappling arms, and latching mechanism for locking said arms in a spread-apart position.

5. Lifting tongs comprising a pair of grappling arms each having a horizontal section, load-supporting toggle links having pivotally-connected upper and lower members said lower members being pivotally connected at their lower ends one to each of said arms, a horizontally disposed bar extending above said arms and pivotally connected at spaced points to each of said lower toggle links, two tie links each pivotally connected at its upper end to said bar and pivotally connected at their lower ends one to each of said grappling arms, said bar forming with each of said arms parallel legs of a parallelogram whose other parallel legs are one of said tie links and the lower portion of the lower member of one of said toggle links, a freely-swinging link connecting together said parallelograms for effecting simultaneous movement of said grappling arms, and two-part latching mechanism for locking one of said grappling arms in a spread-apart condition, one of said parts being carried by said bar and the other by the toggle link member connected to said one arm.

6. Lifting tongs comprising a pair of grappling arms each having a horizontal section, load-supporting toggle links having lower members pivotally connected at their lower ends one to the outer end of each of said arms, a horizontally disposed bar extending above said arms and pivotally connected at spaced points to each of said lower toggle links, two tie links each pivotally connected at its upper end to said bar and pivotally connected at their lower ends to the inner end of each of said grappling arm, said bar form-

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ing with each of said arms parallel legs of a parallelogram whose other parallel legs are one of said tie links and the lower portion of the lower member of one of said toggle links, and a freely-swinging link connecting together the tie link of one parallelogram with said toggle link lower portion of the other parallelogram for effecting simultaneous movement of said grappling arms, said swinging link-connected members being disposed close to one another and having projecting portions for mounting said link.

7. Lifting tongs comprising a pair of grappling arms each having a horizontal section, load-supporting toggle links having the lower member pivotally connected at their lower ends one to the outer end of each of said arms, a horizontally disposed bar extending above said arms and pivotally connected at spaced points to each of said lower toggle links, two tie links each pivotally connected at its upper end to said bar and pivotally connected at their lower ends to the inner end of each of said grappling arm, said bar forming with each of said arms parallel legs of a parallelogram whose other parallel legs are one of said tie links and the lower portion of the lower member of one of said toggle links, a freely-swinging link connecting together the tie link of one parallelogram with said toggle link lower portions of the other parallelogram for effecting simultaneous movement of said grappling arms, said swinging link-connected members being disposed close to one another and having projecting portions for mounting said link, and latching mechanism for locking said arms in a spread-apart position.

8. Coil lifting tongs comprising a pair of shoe-bearing grappling members having horizontal sections, a horizontal bar disposed above said arms, a pair of toggle links each connected to one of said arms for swinging the arms toward and away from each other to grip and release said coil, a pair of parallel vertically-inclined links pivotally connecting each of said arms to said bar, one of said vertically-inclined links of each of said pairs being formed by the lower ends of said toggle links and said bar and arm-connecting links forming with said bar and arms a pair of parallelograms, and a freely-swinging link connecting together said parallelograms for effecting simultaneous movement of said shoe-bearing arms, one of said arms having a horizontal bottom surface adapted to rest squarely on the top of said coil as said arms are moved into and out of coil-grappling positions.

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No references cited.