April 7, 1953 H. J. CRIMMEL 2,634,156

LIFTING HOOK

Filed July 1, 1949 2 SHEETS—SHEET 1

FIG. 1.

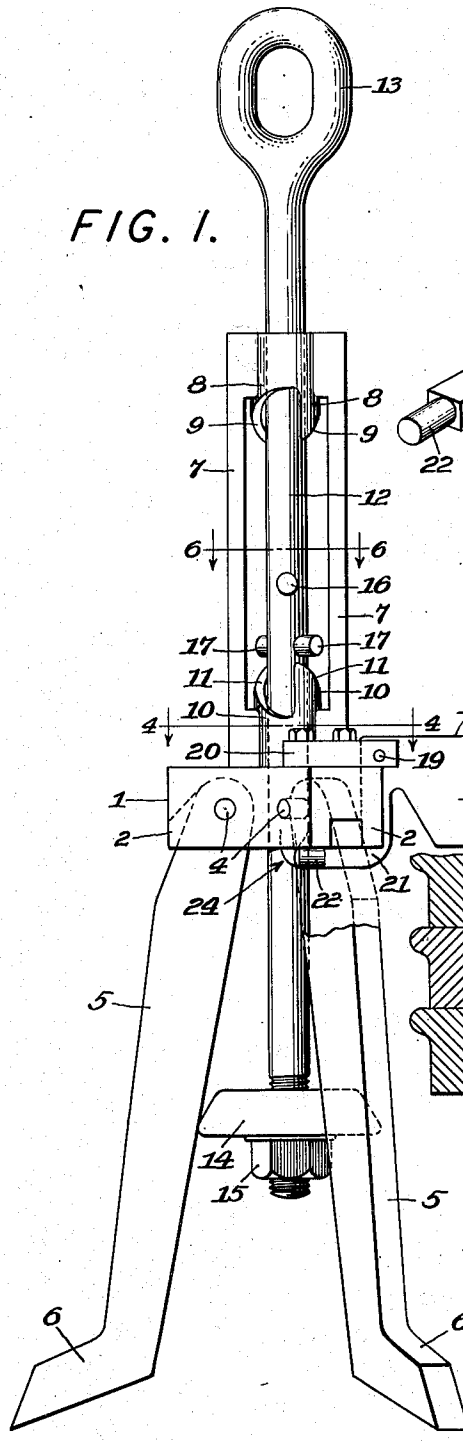


FIG. 5.

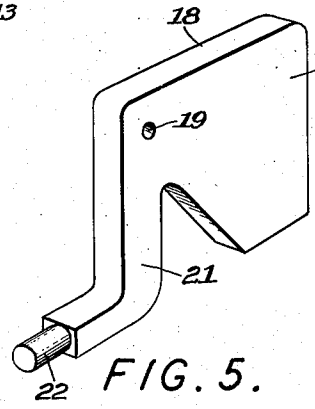


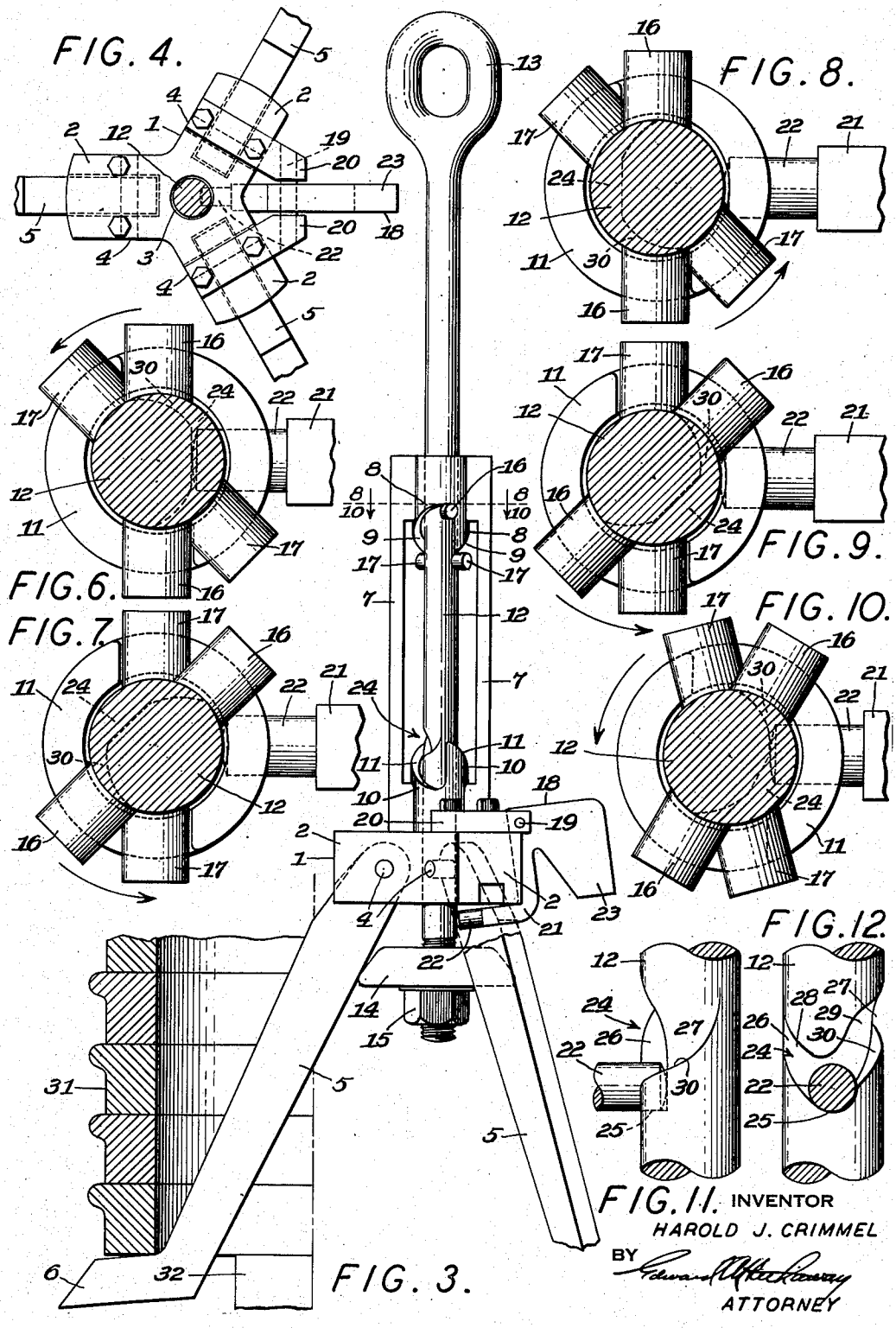
FIG. 2.

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LIFTING HOOK

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16 Claims. (Cl. 294—95)

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This invention relates generally to lifting devices and more particularly to an automatic lifting hook for hollow and other similarly recessed objects such as railway wheel tires.

While my automatic lifting hook may be effectively employed in many industrial shops for a variety of uses, as will be readily apparent, it has especial application to the handling of stacks of steel rings and railway wheel tires in and out of the furnaces of heat treating plants. Various types of lifting hooks have been heretofore proposed and used but the same are deficient in many respects either structurally or functionally, or economically as to its first cost or maintenance.

An object of my invention is to provide an improved lifting hook that is capable in a simple, effective and automatic manner to lock the legs in a collapsed position or unlock the same to allow spreading thereof when the hook is lowered into the stack of tires.

Other objects and advantages will be apparent to those skilled in the art from the following description of the accompanying drawings in which:

Fig. 1 is an elevational view of my improved lifting hook ready to be lowered into or withdrawn from a hollow object, showing the stem thereof locked against upward movement and the legs in collapsed position;

Fig. 2 is a similar view showing the hook with its feet on the ground within a stack of steel tires resting on blocks, the stem being unlocked but the legs still in collapsed position;

Fig. 3 is a similar view to Figs. 1 and 2, showing the hook in position for lifting the stack of tires, the legs being spread so that the feet engage the underside of the stack;

Fig. 4 is a sectional plan view along the line 4—4 of Fig. 1, showing the legs and key pivotally connected thereto;

Fig. 5 is a perspective view of the key;

Figs. 6 to 10 are cross-sectional views respectively along the lines 6—6 of Fig. 1, 7—7 and 9—9 of Fig. 2, and 8—8 and 10—10 of Fig. 3, showing the relation of the cam pins to the lower cams and of the stem cam and recess to the key bolt, as the stem is intermittently rotated spirally to various positions; and

Figs. 11 and 12 are portions of the stem showing the stem cam and recess.

In the particular embodiment of the invention which is disclosed herein merely for the purpose of illustrating one specific form among possible others that the invention might take in practice, I show in Figs. 1, 2 and 3 a structure consisting

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of a leg support 1 having three radial projections 2 and a central vertical opening 3, Fig. 4. Pivoted by pins 4 to projections 2 are legs 5, having outwardly turned ends or feet 6. Vertical cam supports 7 are secured to the upper side of leg support 1, and welded to these supports in axial alignment with each other and with central opening 3 are upper helical cams 8 having faces 9 and lower helical cams 10 having faces 11, both upper and lower cams being formed preferably from tubular sections. Freely movable through these tubular cams and opening 3 is a stem 12 whose upper end forms an eye 13 by which the lifting hook is suspended from a conventional crane hook (not shown) of the swivel type, and whose lower end, extending downwardly within the triangle formed by the three pendant legs, carries a rotatable bell, i. e., spreader, 14 held thereon by a nut 15. Bell 14 is of a diameter larger than that of an imaginary circle touching the inner edges of legs 5 so that as stem 12 raises bell 14, as hereinafter described, legs 5 are spread radially, and as stem 12 lowers bell 14 the legs are allowed to collapse under their own weight. Affixed to stem 12 between the upper and lower cams to cooperate respectively with cam faces 9 and 11 are upper and lower cam pins 16 and 17 vertically offset from each other approximately 45°, as shown in Figs. 6 to 10. Cam faces 9 and 11 are so angularly disposed to the vertical and are so vertically off-set from each other that when stem 12 is allowed by the crane to move vertically downwardly by gravity or when stem 12 is raised vertically by the crane, the upper and lower cam pins, thus respectively brought into contact with cam faces 9 and 11, cause the stem at the end of each such linear stroke to be spiralled in the same direction, the direction chosen for the drawings being counterclockwise, as shown by the arrows in Figs. 6 to 10.

To lock stem 12 in its lowered position to the leg support so that bell 14 cannot be raised to spread the legs when the hook is to be lowered into or withdrawn from a hollow object, I employ a locking means having as one element a flat key 18, Figs. 4 and 5, pivoted at 19 to key supports 20 secured to projections 2 and oscillatable between the projections in a vertical plane of the stem axis. Key 18 is provided with an arm 21 terminating in a cylindrical locking bolt 22 horizontally disposed when in locking position, and with a weighted portion 23 so unbalanced with relation to pivot 19 as to urge bolt 22 continually forwardly against stem 12. As the other element of the locking means, I provide in stem 12 a V-

shaped recess, generally indicated at 24, Figs. 11 and 12, so positioned longitudinally of the stem that when the two locking elements are in engagement bell 14 is in a lowered position and legs 5 therefore collapsed, as shown in Fig. 1. This V-shaped recess is cut deepest at its lowest point 25 where it is concavely rounded to accommodate bolt 22, as shown in Fig. 12. Arms 26 and 27 of the V, forming respectively exit and entrance channels for the bolt, spiral upwardly in opposite directions from lowest point 25, becoming gradually less in depth until they merge with the surface of the stem. The surfaces of these arms 26 and 27 constitute two cams. The upper edges of these spiraling channels are rounded to provide sloping areas 28 and 29. The lower edge of entrance channel 27, however, is squared to form a helical stem cam 30 with which locking bolt 22, serving as a cam pin, cooperates for partially spiraling the stem in the manner and for the purpose hereinafter described.

Operation.—Figs. 1 and 6 show the relative position of the moving parts of the hook when locked and ready for lowering by a crane into a hollow object to be lifted as, for instance, a stack of steel tires 31 resting on blocks 32, Fig. 2. Locking bolt 22 is shown in engagement with lowest point 25 of V-shaped recess 24, and bell 14 consequently is in a lowered position with legs 5 collapsed. When the hook has been lowered into the stack to the point where feet 6 have come into contact with ground 33, the operator continues to lower the crane thereby allowing stem 12 to move downwardly under its own weight relative to the rest of the hook. Lower cam pins 17, also moving vertically downwardly with the stem, strike cam faces 11 to start stem 12 spiraling during its downward descent, in a counterclockwise direction as viewed from above, to the position shown in Figs. 2 and 7. This downward spiraling of the stem causes locking bolt 22 to ride in exit channel 26 which also moves the bolt backwardly against the force of weighted portion 23 until the bolt is completely disengaged from recess 24 and rests against the outermost surface of stem 12 at a slight angle thereto, Fig. 2. At this time the operator discontinues lowering the crane. It will be seen from Figs. 2 and 7 that recess 24 has now been moved through the leg support 1 and is now below bolt 22. Also, the recess has been rotated approximately 135° from its original position. The operator now raises the crane, thereby raising stem 12 from the position shown in Figs. 2 and 7 to that shown in Figs. 3 and 8 during which movement bell 14, also moving upwardly, spreads legs 5 radially until feet 6 are beneath the stack of tires. Upper cam pins 16 are also caused during said upward movement of stem 12 to engage cam faces 9 of upper cams 8 and thereby cause spiraling of stem 12 in a counterclockwise direction. The sole purpose in rotating the stem on this upward movement is merely to carry lower cam pins 17 over the high points of lower cams 10 so that on the next downward movement of the stem they will engage cam faces 11. It will be seen from Fig. 8 that the cam pins have assumed the same positions as shown in Figs. 1 and 6 but are turned end for end. Also, that the V-shaped recess 24 has moved to a position above the leg support, diametrically opposite its initial position shown in Figs. 1 and 6, when in engagement with bolt 22. With the moving parts of the hook in the positions of Figs. 3 and 8, the operator continues the upward movement of the crane so that the stack of tires is carried upwardly to its destination and finally lowered on other supporting members similar to blocks 32. As feet 6 again come into contact with the ground or other surface, the operator again allows the crane to continue downwardly, thereby allowing stem 12 to move downwardly by gravity to a point similar to that shown in Fig. 2 but rotated 135° so that recess 24 is in the position shown in Fig. 9. This rotation is accomplished during such downward movement by reason of lower cam pins 17 again striking cam faces 11 to cause stem 12 to spiral in a counter-clockwise direction. During such downward movement the V-shaped recess 24 has again passed through the leg support and come to rest at a point below bolt 22. It is to be understood that during the initial portion of this second vertical downward stroke of the stem, recess 24 remains on the side of the stem diametrically opposite bolt 22, as shown in Fig. 8, until lower cam pins 17 strike cam faces 11 which then rotate the recess until the sloping area 29 is in vertical alignment with bolt 22 as shown in Fig. 9. Thus does sloping area 29 arrive at a position vertically beneath bolt 22 without coming into contact therewith on such downward stroke. As stem 12 is again vertically raised by the crane in the final phase of the operation cycle, sloping area 29, coming into contact with bolt 22 allows the bolt, now serving as a cam pin, to move into entrance channel 27 to engage helical stem cam 30, Fig. 12. Such engagement causes stem 12 to be spiraled in a counterclockwise direction during its continued upward movement to the position shown in Fig. 1, thereby to rotate the recess and cam pins to the positions shown in Fig. 6. An intermediate stage of this final movement, Fig. 10, shows the bolt 22 riding in the entrance channel 27 towards its final locking position of Fig. 6. When stem 12 has been so spiraled by bolt 22 acting against the stem cam, to the point where the bolt is at lowest point 25 of the recess the stem is prevented from further upward relative movement with respect to the remainder of the hook. This is considered the locked position. As bell 14 is now in its downmost position and is similarly locked in this position against upward movement, the hook may now be lifted out of the opening of the stock of tires and legs 5 will automatically collapse from beneath the stack of tires. This automatic collapsing of the legs is brought about because the center of gravity of the legs is located outside of the vertical position of the pivotal points of the legs thereby creating a force which biases the legs inwardly to their collapsed position. This force is rendered effective during downward movement of the stem 12 relative to the legs to move the same toward each other. The mass distribution in the legs to provide the foregoing biasing force broadly constitutes means that is rendered effective during such relative downward movement of the stem. To hold bolt 22 more securely in recess 24 during this locked position, it will be seen that the pivotal point 19 of key 18 is located so that the bolt comes into engagement with the recess directly beneath the lower side of the leg support, as clearly shown in Fig. 1. Accordingly, when the hook in locked position is lifted by the crane, the bolt is gripped between the upward pressure of lowest point 25, Fig. 12, of V-shaped recess 24 and the down-

ward pressure caused by the weight of the leg support, legs, etc.

The last rotation of the stem has the further purpose of carrying the lower cam pins 17 past the high points of lower cams 10 so that they will be ready to engage the lower cams when the cycle of operation is to be repeated.

Besides the time and energy saving features possessed by my automatic lifting hook, it is believed that by the use of the hook in heat treating plants the total charge in a furnace can be increased appreciably and that there will be no excess material in the furnace to heat up along with the heat treating charge.

From the disclosure herein, it is seen that I have provided an improved lifting hook that can be automatically connected to and disconnected from tubular and other similarly recessed objects to be lifted, that is simple in construction and operation, rugged and dependable in performance, and relatively inexpensive to manufacture and maintain.

It will, of course, be understood by those skilled in the art that various changes may be made in the construction and arrangement of parts without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A lifting hook comprising, in combination, a plurality of footed legs, relatively pivotally connected together, a vertical stem whose upper end is for connection to a crane to lift and lower the hook, means actuated by the stem during upward movement thereof relative to the legs for spreading the same for lifting a load, means rendered effective during downward movement of the stem relative to the legs to move the same toward each other in a collapsed position for unloading, means for locking the stem in said leg collapsing position whereupon the stem can lift the collapsed legs, and means rendered operative by lowering and then lifting said stem relative to said legs for releasing said locking action whereby upon release of said locking action the stem can move upwardly relative to the legs to effect spreading thereof.

2. A lifting hook comprising, in combination, a plurality of footed legs relatively pivotally connected together, means movable in one direction for engagement with the legs for spreading the same for lifting a load, means rendered effective when said engaging means is moved in the opposite direction relative to the legs to move the same toward each other in a collapsed position for unloading, a vertical stem connected to said spreading means and having a connection for a crane to lift and lower the hook, and means for rendering said leg engaging means operative to spread the legs or to effect their collapse including mechanism for controlling said spreading and collapsing action by angularly adjusting said stem automatically in response to raising and lowering thereof.

3. A lifting hook comprising, in combination, a plurality of footed legs, relatively pivotally connected together, a vertical stem for connection to a crane to lift and lower the hook, means actuated by the stem during upward movement thereof relative to the legs for spreading the same to a loading position, means whereby downward movement of said stem relative to the legs effects inward movement thereof to a collapsed position for unloading, means for locking the stem in a predetermined lower position in which the legs are collapsed, and means for releasing said locking action to allow upward movement of the stem relative to the legs and thereby spread the same including mechanism for controlling said spreading and collapsing action by angularly adjusting said stem automatically in response to raising and lowering thereof.

4. The combination set forth in claim 3 further characterized by the provision of means whereby said unlocking and locking action is initiated by axial movement of the stem arising from lifting and lowering of the stem by the crane.

5. A lifting hook comprising, in combination, a plurality of footed legs, relatively pivotally connected together, a vertical stem for connection to a crane to lift and lower the hook, means actuated by the stem during upward movement thereof relative to the legs for spreading the same to a loading position, means rendered effective during downward movement of the stem relative to the legs to move the same toward each other to a collapsed position for unloading, means for angularly adjusting said stem to prevent spreading of the legs in response to upward movement of the stem, and means for effecting said angular adjustment automatically in response to a predetermined axial movement of said stem relative to the legs.

6. A lifting hook comprising, in combination, a plurality of footed legs, relatively pivotally connected together, a stem for connection to a crane to lift and lower the hook, means actuated by the stem during upward movement thereof relative to the legs for spreading the same to a loading position, means rendered effective during downward movement of the stem relative to the legs to move the same toward each other to a collapsed position for unloading, a plurality of cams axially spaced along said stem and cam follower means for cooperation with said cams, said cams and follower means angularly rotating the stem upon axial movement thereof, and means connected to said stem for rendering said spreading means either operative for spreading the legs or for allowing the same to collapse in response to said axial and angular movement of the stem.

7. In a lifting hook employing a support having a vertical central opening, footed legs pivoted to the support, a stem axially and rotatably movable through the central opening, the upper end of said stem having provision for attachment to a lifting means, and leg controlling means mounted on the stem to spread the legs to a loading position as the stem is moved upwardly relative to the legs and to allow inward movement of the legs to a collapsed unloading position when the stem is moved downwardly relative to the legs, automatic stem locking and unlocking means comprising, in combination, a locking bolt biased into engagement with the stem, a recess formed in the stem for receiving the bolt to lock the stem in a predetermined downward position, and means for spiraling the stem as the stem is moved vertically by the lifting means so that on an upward movement of the stem relative to the legs the recess is spiraled into locking engagement with the bolt and on a downward movement relative to the legs the recess is spiraled out of locking engagement with the bolt.

8. In a lifting hook, automatic stem locking and unlocking means, as defined in claim 7, further characterized in that the means for spiral-

ing the stem as the stem is moved vertically consists of upper and lower helical cams in proximity to the stem, means secured to the support and to the cams for holding the cams in spaced apart relation, cam pins affixed to the stem to engage the cams, and a helical cam formed in the stem to be engaged by the locking bolt serving as a cam pin.

9. In a lifting hook, automatic stem locking and unlocking means, as defined in claim 7, further characterized in that the means for spiraling the stem as the stem is moved vertically consists of upper and lower helical cams in proximity to the stem, means secured to the support and to the cams for holding the cams in spaced apart relation, cam pins affixed to the stem to engage the cams, and a helical cam formed in the stem to be engaged by the locking bolt serving as a cam pin, said upper and lower cams being disposed around the stem and facing each other and being provided with faces disposed at angles such that engagement of the cam pins therewith causes the stem to be spirally rotated in the same direction.

10. In a lifting hook, automatic stem locking and unlocking means, as defined in claim 7, further characterized in that the recess in the stem is positioned longitudinally thereof so that when the locking bolt and recess are in locking engagement the leg controlling means is in a lowered position and the legs are collapsed.

11. In a lifting hook, automatic stem locking and unlocking means, as defined in claim 7, further characterized in that the locking bolt is positioned to be engaged by the recess at a point immediately beneath the support so that when the hook is in locked position and is lifted by the lifting means the bolt is gripped between the upward pressure of the lower side of the recess and the downward pressure caused by the weight of the hook, thus holding the bolt more securely in the recess.

12. In a lifting hook, automatic stem locking and unlocking means, as defined in claim 7, further characterized in that the recess in the stem is V-shaped, being deepest at its lowest point to receive the locking bolt and becoming gradually less in depth as the arms of the V spiral upwardly to merge with the surface of the stem.

13. In a lifting hook, automatic stem locking and unlocking means, as defined in claim 7, further characterized in that the recess in the stem is V-shaped, being deepest at its lowest point to receive the locking bolt and becoming gradually less in depth as the arms of the V spiral upwardly to merge with the surface of the stem, said helical cam in the stem being formed of one edge of the V-shaped recess and being disposed at such an angle that engagement of the stem cam with the locking bolt causes the stem to be spiraled in the same direction that the stem is rotated by the upper and lower cams.

14. The combination set forth in claim 7 further characterized in that the locking bolt is pivotally mounted on the support and has provision for being continuously biased into engagement with the stem.

15. A lifting hook comprising, in combination, a plurality of footed legs relatively pivotally connected together, a vertical stem whose upper end is for connection to a crane to lift and lower the hook, means actuated by the stem during upward movement thereof relative to the legs for spreading the same to a loading position, means rendered effective during downward movement of the stem relative to the legs to move the same toward each other to a collapsed position for unloading, means for locking the stem in said lower position, and means for effecting said locking action automatically by lowering the stem relative to the legs to a predetermined position and then lifting the stem.

16. A lifting hook comprising, in combination, a plurality of footed legs relatively pivotally connected together, a vertical stem whose upper end is for connection to a crane to lift and lower the hook, means actuated by the stem during upward movement thereof relative to the legs for spreading the same to a loading position, means rendered effective during downward movement of the stem relative to the legs to move the same inwardly to a collapsed position for unloading, means for locking the stem in said lower position, means for initiating said locking action automatically by lowering the stem relative to the legs to a predetermined position, and means for completing the locking action by subsequently lifting the stem whereupon the stem can lift the collapsed legs.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,169,004	Cargin	Jan. 18, 1916
1,317,500	Holmquist	Sept. 30, 1919
1,569,918	Flynn	Jan. 19, 1926