

Jan. 24, 1956

W. P. GAINES

2,732,244

HOOKE POSITIONER

Filed Dec. 5, 1950

5 Sheets-Sheet 1

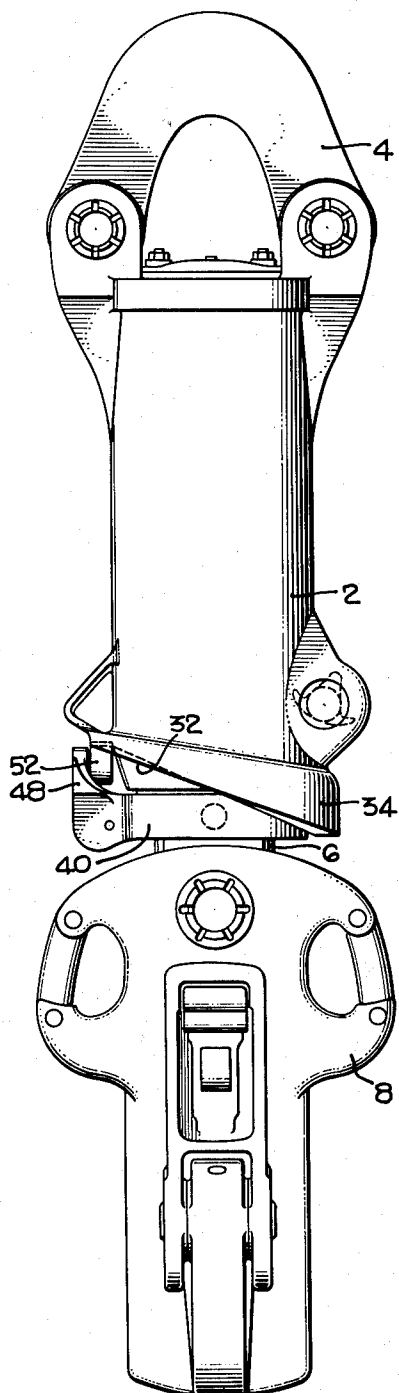
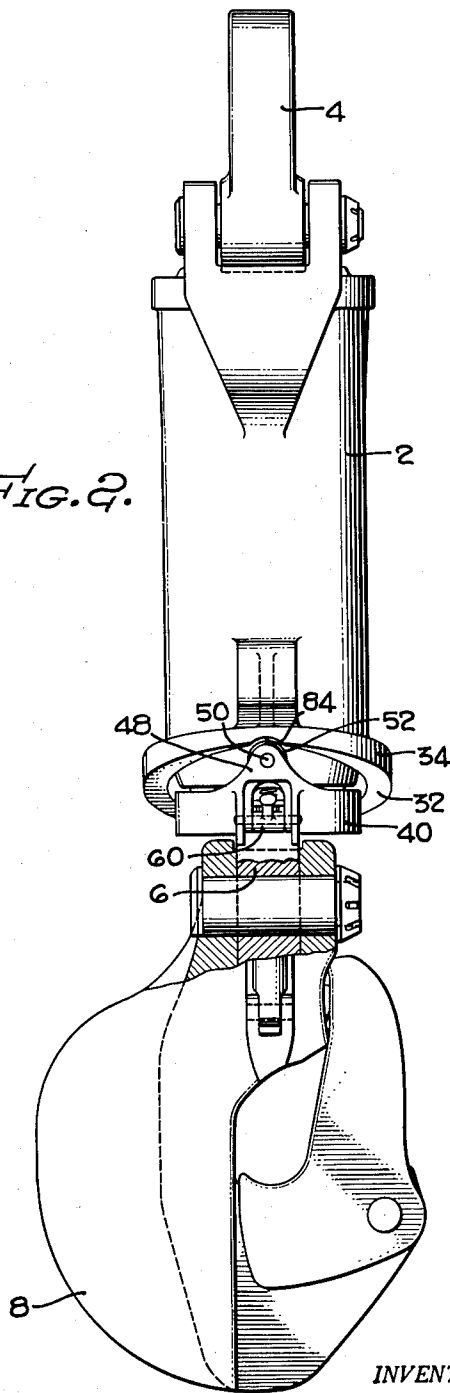


FIG. 1.

FIG. 2.



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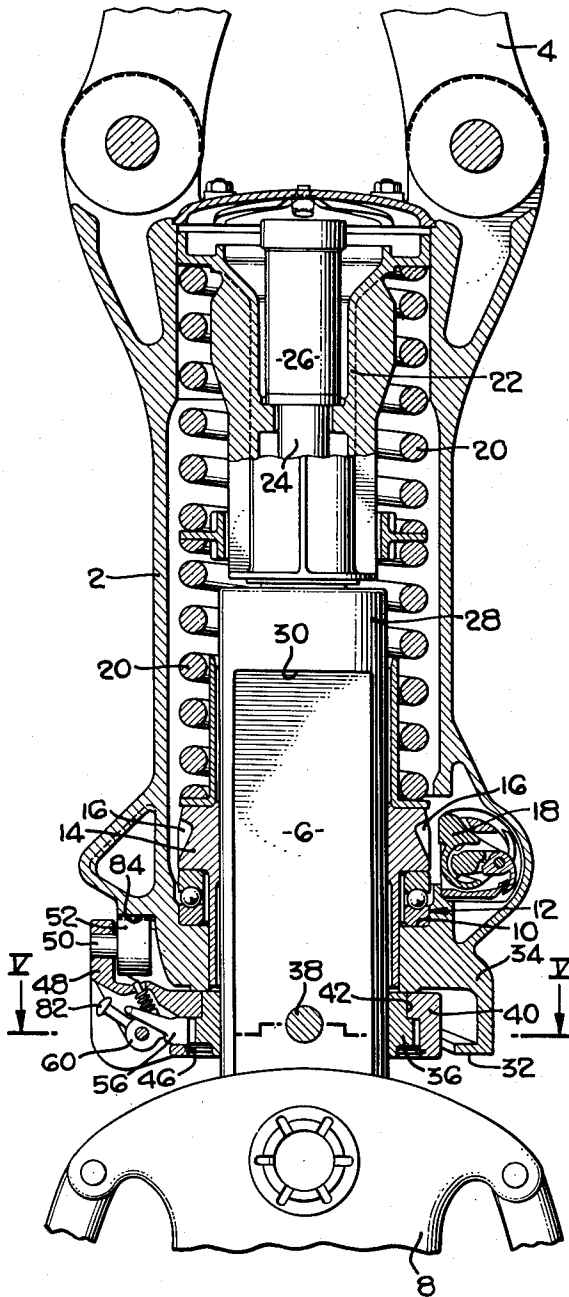


FIG. 4.

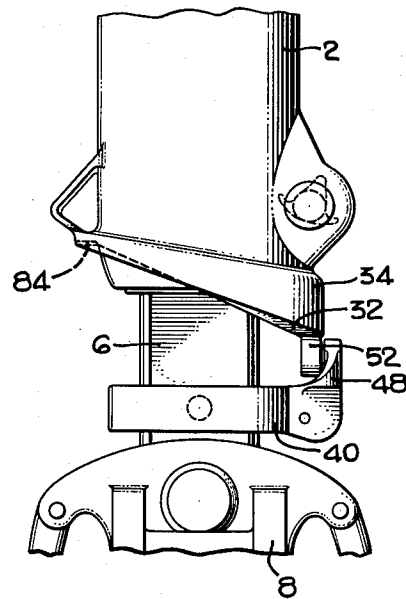


FIG. 3.

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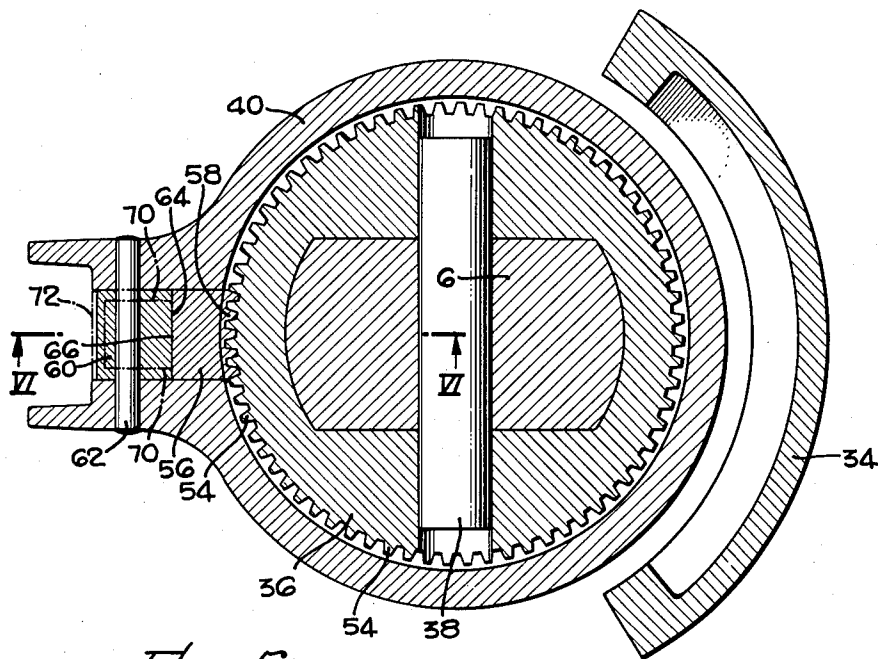


FIG. 5.

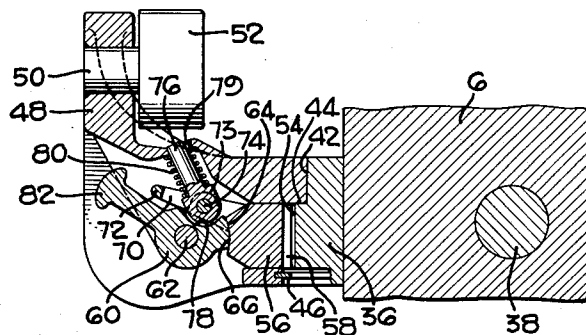
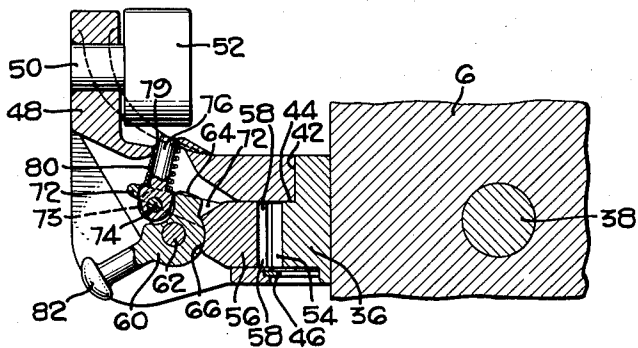


FIG. 6a.

FIG. 6.



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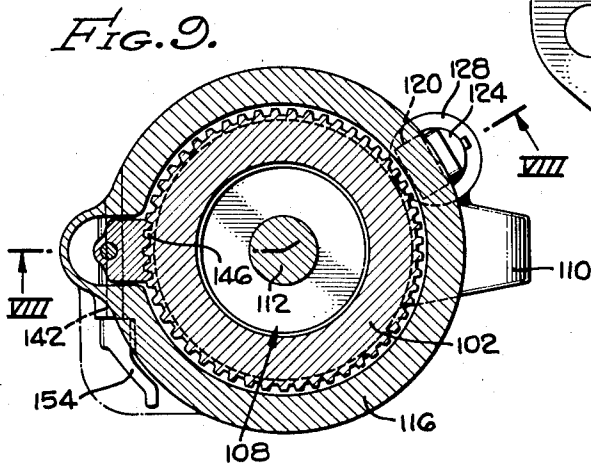
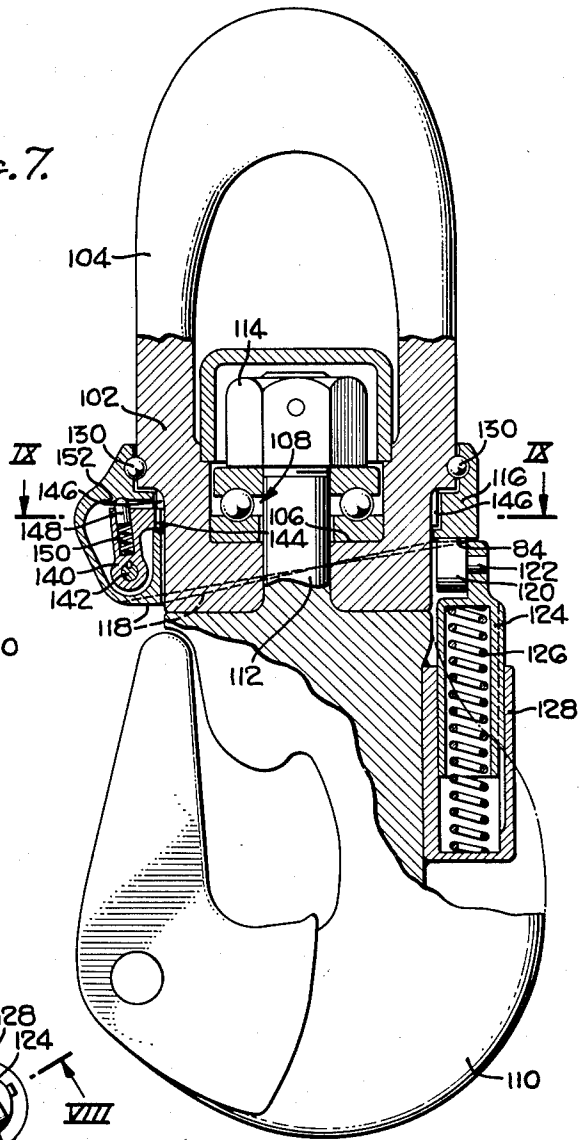
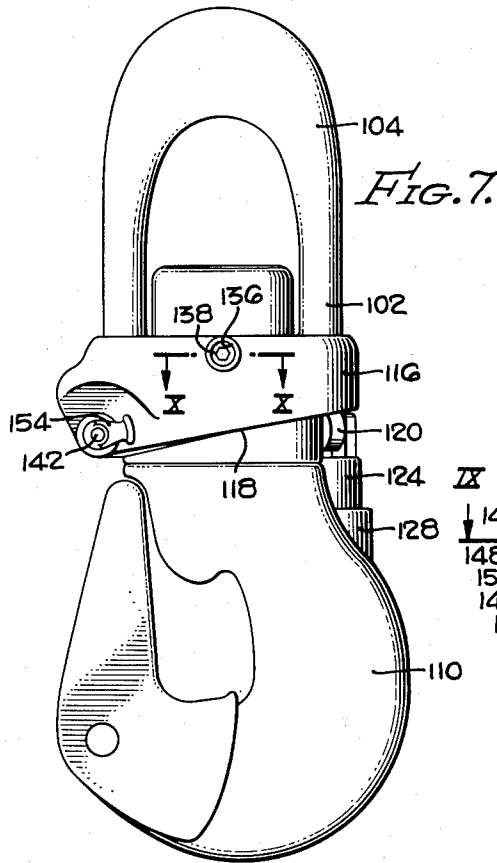
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5 Sheets-Sheet 4



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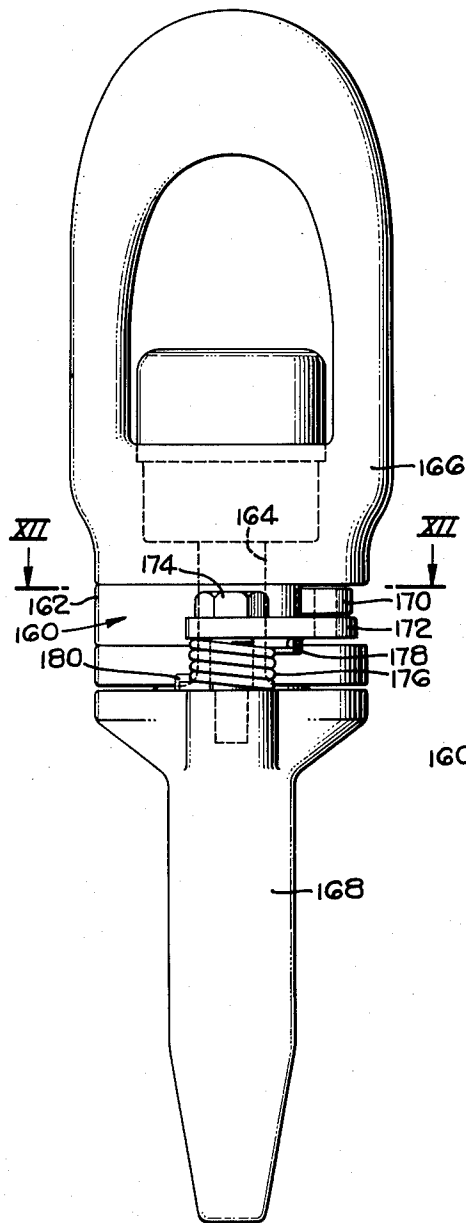


FIG. 11.

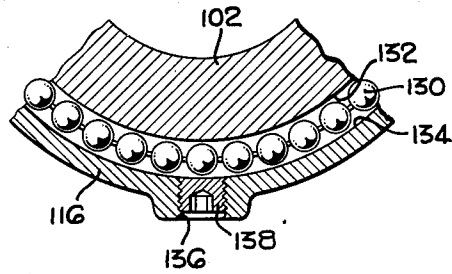


FIG. 10.

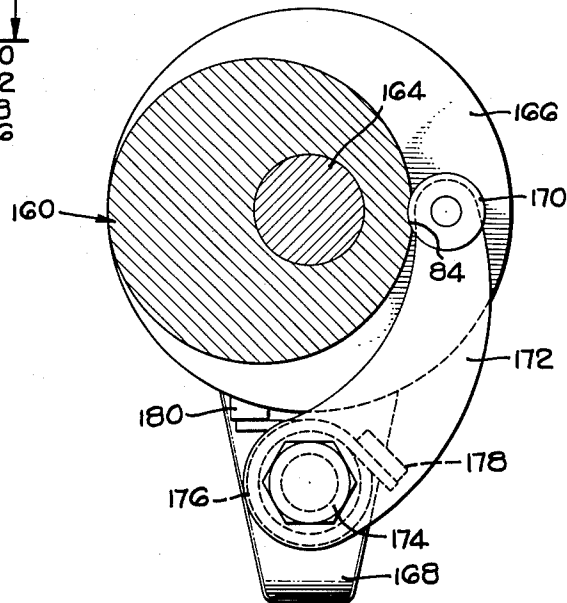


FIG. 12.

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2,732,244

HOOK POSITIONER

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Application December 5, 1950, Serial No. 199,229

15 Claims. (Cl. 294—82)

This invention relates generally to hook structures and the like of the type generally used to support and to raise or lower well casing, drill pipe, well tubing or sucker rods in a well. The invention is more particularly directed to an improvement in such structures to facilitate the handling of well pipe or rods when lowering or raising them into or out of a well.

When a well is being drilled for the production of fluids such as oil, gas or water, it is customary to support the string of drill pipe by a drilling hook structure suspended from a traveling block which in turn is suspended in the derrick by a drilling line. When the drilling bit becomes dull the drill string, which comprises threaded connected sections, is pulled from the well and the disconnected sections or "stands" are stacked upright in the derrick. After replacement of the bit the drill string is run back into the well by screwing the stands together and lowering the drill string the length of a stand as each stand is added. During these operations the drill string is supported by an elevator flexibly suspended from the drilling hook structure by a pair of elevator links. The elevator is composed of pivotally interconnected sections which may be swung apart to provide a lateral opening permitting lateral insertion of the pipe into the bore of the elevator and then closed and latched about the pipe.

The manipulation of the upper ends of the disconnected stands of pipe is performed or controlled by an operator on a platform mounted in the upper portion of the derrick, this operator being usually referred to as the "derrick man." When pulling the pipe from the well, or "coming out of the hole," in accordance with conventional practice it is the derrick man's duty to unlatch the elevator from each stand and to move the upper end of the stand into position in the pipe rack. When running the pipe into the well, or "going in the hole," it is his duty to move the upper end of each stand into position to be inserted laterally into the elevator bore, and to close and latch the elevator unless the elevator is of a type which is automatically closed and latched upon insertion of the pipe thereinto. It will be apparent that in order to avoid delay and interruption of the cycle of operation, when "going in the hole" the empty elevator should be properly oriented as it is raised in the derrick, so that its lateral opening faces the stand of pipe to be engaged. Heretofore it has not been possible to insure such proper orientation of the elevator at this time, for the following reasons.

For various practical reasons drilling hook structures embody the following essential elements and features:

(1) A hook member or its equivalent load-carrying member by which the pipe is supported;

(2) A supporting member adapted to be attached to and supported by the traveling block;

(3) An axially slidable and rotative connection between the hook member and the supporting member whereby the hook member may rotate about a vertical axis and may have limited axial movement relative to the supporting member;

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(4) Spring means between the members resisting downward movement of the hook member relative to the supporting member; and

(5) Means for releasably locking the hook member against rotation without interfering with the aforesaid relative axial movement.

The purpose of the relative axial movement and of the spring loading of the hook member is to cause the hook to raise the stand of pipe a few inches as it is unscrewed from the drill string and thus avoid damage to the joint threads, the spring having sufficient force to expand under the load of a single stand of pipe. The purpose of the rotative connection and of the rotation lock is to enable the hook member to be rotated into different positions and to be locked against rotation in any one of several positions. For instance, during the drilling operation a portion of the torque applied to the drill string by the rotary table is imparted to the rotary swivel, which must be restrained against rotation because of the mud hose connected thereto. By locking the hook member against rotation, the rotary swivel is prevented from rotating.

When "coming out of the hole" it is customary to lock the hook against rotation, in such position that the elevator opening is disposed toward the pipe rack. However, when "going in the hole" there is frequently a tendency for the drill string to be rotated by the drill bit as it descends, due to a "corkscrew" effect which is most pronounced in crooked wells. If the upper end of the drill string were held against rotation under these circumstances, there is a danger that one of the threaded joints in the drill string may become loosened and allow a portion of the drill string to drop to the bottom of the well. For this reason it is considered essential that the hook swivel lock be released while "going in the hole." Consequently each time the elevator is unlatched and removed from the pipe at the floor level and before it is raised to the upper portion of the derrick to engage another stand of pipe, the hook, links and elevator must be manually rotated by a crew member to a position wherein the elevator opening faces the next stand of pipe. This necessitates a pause in the operating cycle, slowing down the operation. Even after being properly oriented at the floor level the elevator frequently turns slightly during its ascent, due to vibration and swaying, so that when it reaches the upper portion of the derrick its lateral opening is not directed toward the stand of pipe to be inserted therein. This results in additional delay which cannot be avoided by locking the hook at the floor level in the proper position, for the reason that when it is in the upper position the lock is not accessible to the derrick man for release by him to permit free rotation during subsequent lowering of the drill string.

The instant invention, when applied to spring-type drilling hook structures, overcomes this difficulty and reconciles the two aforementioned conflicting conditions by providing means whereby the hook is automatically rotated into a predetermined position upon release of the weight of the drill string, and is maintained in such position until the weight of the drill string is again imposed on it, whereupon the hook member is rendered freely rotatable with respect to its supporting member. According to one aspect of the instant invention, the stored energy in the hook spring is used to rotate the hook into the desired position. More specifically, this application of the invention contemplates the provision of coacting cam and follower elements, one associated with the hook member and the other associated with the supporting member and cooperating to rotate the hook member into a predetermined position during expansion of the spring upon release of the applied load.

In different drilling rigs the location of the pipe rack with respect to the drawworks varies considerably, and

hence the elevator should be capable of being positioned with its lateral opening facing in any desired direction. Furthermore, different makes and types of elevators have lateral openings which face in directions which vary somewhat with respect to the hook member. Accordingly, another aspect of the instant invention contemplates adjustability of one of the cam members throughout an entire revolution about the axis of rotation of the hook member, into any one of a plurality of angularly spaced positions, and preferably permitting adjustment by small increments so that a predetermined position which the unloaded elevator automatically assumes may be selected to provide optimum working conditions for the derrick man.

In addition to its advantages in improving operating conditions when incorporated in a drilling hook structure, the instant invention is also applicable to tubing hook structures and sucker rod hook structures. When running strings of well production tubing or sucker rods into or out of the well, the disconnected stands are racked upright in the derrick or the mast of the pulling unit, and operating conditions are generally similar to those prevailing in the running of a string of drill pipe. An appreciable saving in time and effort may be effected by incorporating in a tubing hook structure or sucker rod hook structure cooperating elements operable to automatically orient the hook member and hence the elevator into a predetermined position.

Whereas all drilling hook structures incorporate a relief spring, not all tubing hook structures are of this type. Many tubing hook structures provide for rotation of the hook member, with or without a releasable rotation lock, but with no axial movement of the hook member relative to the supporting member. Accordingly, in the application of the instant invention to this type of hook structure either the cam or its follower may be spring-mounted on one of the members of the hook structure, thus providing for relative movement between the cam and its follower upon deflection of the spring. In this case the cooperating cam elements will constantly urge the hook member into a predetermined oriented position, both while the hook is loaded and while it is unloaded, but will permit the hook member to rotate if the rotational force is sufficient to deflect the cam spring.

The invention and its application to various types of hook structures will be understood from the following detailed description of a drilling hook structure incorporating the invention, and of a typical tubing hook structure having no relief spring but incorporating a different version of the invention, reference being had to the accompanying drawings wherein:

Figure 1 is a view in side elevation of an unloaded spring-type drilling hook embodying the invention;

Figure 2 is a side elevational view taken at right angles to Figure 1;

Figure 3 is a view similar to Figure 1 but showing the hook loaded and rotated through an angle of 180°;

Figure 4 is a view similar to Figure 1 with parts broken away on a central longitudinal plane;

Figure 5 is a transverse sectional view taken on line V—V of Figure 4;

Figure 6 is a fragmentary longitudinal view taken on line VI—VI of Figure 5;

Figure 6a is a view similar to Figure 6 but showing the locking mechanism in released position;

Figure 7 is a view in side elevation of a tubing hook of the non-spring type incorporating the instant invention;

Figure 8 is a view similar to Figure 7 but with parts broken away on line VIII—VIII of Figure 9;

Figure 9 is a transverse sectional view taken on line IX—IX of Figure 8;

Figure 10 is a fragmentary sectional view taken on line X—X of Figure 7;

Figure 11 is a view in rear elevation of a modified

form of the invention applied to a hook of the type shown in Figures 7 to 10; and

Figure 12 is a transverse sectional view taken on line XII—XII of Figure 11.

Referring first to Figures 1 to 6, inclusive, wherein the invention is shown as embodied in a spring-type drilling hook structure, it will be observed that the supporting member comprises generally a housing 2 having a bail 4 attached to its upper extremity for suspending the structure from a traveling block. The load carrying member includes a main shank 6 slidably and rotatably mounted in the housing 2, the lower portion of the shank projecting below the housing and carrying a hook body generally designated 8. An upwardly facing internal shoulder 10 is formed in the housing adjacent its lower end, on which rests a thrust bearing 12 which rotatably supports a lock ring 14 having a plurality of locking recesses 16 in its peripheral surface. A locking member 18 is pivotally mounted in the housing 2 for movement selectively into or out of engagement with a selected recess 16.

In the foregoing and throughout the specification, as well as in the claims, the conventional nomenclature commonly accepted throughout the industry is utilized, thus the whole structure is designated as a hook structure while the term "hook" or "hook body" refers only to the load-carrying member or members of the hook structure. Despite possible confusion between the term "hook structure," "hook," "hook body" or "hook element," this terminology is adhered to as compatible with the literature and prior patents of this art. Since common variations of hook structures include many transpositions and rearrangements of parts, such for instance, as inclusion of the housing as a part of the hook member and the shank as an element of the supporting member, this language is deemed properly appropriate to describe the invention in the common parlance already established in this field.

A compression spring 20 is supported by the lock ring 14, the upper end of the spring having supporting engagement with a collar 22. A shank extension 24 is secured to the main shank 6 in coaxial relation thereto, the upper end of the shank extension being threaded to receive a nut 26 by which the collar 22 is secured to the shank extension.

The major portion of the shank 6 is flattened on opposite sides to provide a non-circular cross-section, as illustrated in Figure 5, and the lock ring 14 is provided with a correspondingly shaped opening therethrough, whereby the shank may slide freely through the lock ring but is prevented from rotating with respect thereto. Above the flattened portion of the shank 6 there is provided a cylindrical head 28 integral with the flattened portion and forming a pair of downwardly facing shoulders 30 adapted to engage the lock ring 14 and thus limit the extent of compression of the spring.

The construction thus far described forms no part of the instant invention, and is substantially as illustrated and described in United States Patent No. 2,506,593, granted May 9, 1950 to R. K. Hertel and G. F. Nicolson, to which reference may be had for a more detailed disclosure of the construction.

As previously mentioned, the swivel locking member 18 is customarily disengaged from the locking recesses 16 in the lock ring 14 when running the drill pipe into the well, in order not to restrain the drill pipe from rotating if "cork-screwing" of the bit tends to rotate it. On the other hand, when the hook structure is unloaded during such operation, such as when it is being raised to pick up the next stand of pipe from the pipe rack, it is highly desirable that the hook body 8 assume a predetermined oriented position such that the lateral opening in the elevator faces the stand of pipe to be picked up. The instant invention, as applied to this type of hook structure, provides such predetermined orientation of the hook

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body when it is unloaded and also permits free rotation of the hook body while the hook body is supporting the weight of the drill string.

Referring to Figures 1 to 3, it will be noted that the lower portion of the housing 2 is provided with a downwardly facing annular cam surface 32 which encircles the housing. This cam surface is formed on a sleeve or boss 34 which may either be an integral part of the housing or may be welded or otherwise rigidly secured to the housing. As shown most clearly in Figures 4 and 5, a collar 36 is secured by a transverse pin 38 to the shank 6, the upper surface of the collar abutting the lower end surface of the housing 2 when the hook body is unloaded and thus limiting the upward movement of the shank under the expansive force of the spring 20. The collar 36 also serves to rotatably support a cam follower ring 40, and to this end the upper portion of the collar is of reduced outer diameter, as indicated at 42 in Figure 6, providing a supporting shoulder 44 for the ring 40. A retaining ring 46 engages an internal groove in the lower portion of the ring 40 and abuts against the underside of the collar 36 to retain the ring 40 on the shoulder 44.

The ring 40 is provided with an upward projection 48 in which is mounted a roller pin 50 on which is journaled a cam follower roller 52 which is adapted to coast with the cam surface 32 to effect predetermined orientation of the hook body 8 with respect to the housing 2. It is considered desirable that the coaction of the cam and follower be effective to orient the hook body into any one of a plurality of angularly related positions. This may be accomplished by providing for angular adjustment of either the cam or the cam follower about the axis of the hook. In the illustrated embodiment the cam follower ring 40 is rotatably mounted on the collar 36 and releasable locking means are provided whereby the ring may be locked in any adjusted position.

Referring particularly to Figures 5 and 6, it will be observed that the periphery of the collar 36 is provided with a circumferential series of teeth 54. A locking member 56 is movably mounted in a recess in the ring 40 and has teeth 58 formed thereon which are adapted to intermesh with a selected group of the teeth 54. The locking member 56 may be retracted radially outwardly to disengage it from the collar 36, by means of an actuator 60 journaled on a transverse pivot pin 62 mounted in the ring 40. A convex locking surface 64 is formed on the actuator 60 and, as shown in Figure 6, engages a concave surface 66 on the locking member 56. These surfaces are concentric with the axis of the pivot pin 62 whereby any radially outward component of thrust exerted on the locking member 56 by the beveled teeth 54 and 58 will be transmitted radially toward the axis of the pivot pin 62, with no tendency to rotate the actuator 60 in either direction.

The locking member 56 is provided with a pair of outwardly extending arms 70 interconnected at their outer extremities by a cross arm 72. The actuator 60 is provided with a pair of pivot bosses 73 with aligned bores to receive a pivot pin 74, on which is journaled the head portion of a plunger 76. The plunger head is rounded and projects into a recess 78 formed in the actuator 60. The opposite end of the plunger projects through an opening 79 in the upper wall of the ring 40, and a compression spring 80 is interposed between the plunger head and the inner surface of the ring 40. It will be noted that in Figure 6 the plunger pivot pin 74 is disposed to the right of a line extending between the axis of the actuator pivot pin 62 and the free end of the plunger, whereby the plunger spring 80 biases the actuator into locking position. Upon depressing the lever portion 82 of the actuator 60, the plunger pivot pin 74 is moved outwardly in an arcuate path about the axis of the actuator pivot pin 62, thus causing the plunger 76 to rock about its free end which is loosely pivoted in the wall opening 79. It will be understood that the locking

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member 56 cannot move outwardly until the locking surface 64 on the actuator is fully disengaged from the cooperating locking surface 66 on the member 56. When this condition is attained, a slight additional movement of the actuator 60 causes the head of the plunger 76 to engage the cross arm 72, whereupon continued movement of the actuator moves the locking member 56 outwardly to disengage the teeth 58 from the teeth 54. The final position of the actuator is shown in Figure 6a, wherein it will be noted that the plunger pivot pin 74 is disposed outwardly of a line extending between the axis of the actuator pivot pin 62 and the free end of the plunger. The spring 80 thus biases the actuator 60 and the locking member 56 toward their released positions. The ring 40 may then be rotated into another position and locked therein by raising the actuator lever 82 upwardly and returning the locking mechanism to the position shown in Figure 6.

The operation of the above-described positioning device is as follows: When the elevator is disengaged from the drill string the hook spring 20 is expanded and the hook elements assume the relative positions shown in Figures 1, 2 and 4, with the cam follower roller 52 at the uppermost point on the cam surface 32. When running the drill pipe into the well the hook structure and the empty elevator are raised in the derrick to engage the elevator with the upper end of a stand of pipe in the pipe rack, whereupon the stand is lifted off the rack and connected to the upper end of the drill string supported in the rotary table. The weight of the entire drill string is then taken on the hook body, which causes the hook spring to be compressed and the hook body 8 and its shank 6 to move downwardly, as indicated in Figure 3. In this position the cam follower roller 52 is disposed below the lowermost point on the cam surface 32, and hence the hook body and shank are free to rotate about the axis of the shank. It will be understood that during this sequence of operations the conventional swivel lock 18 is disengaged from the locking recesses 16 in the lock ring 14. Accordingly, any tendency of the drill string to rotate as it is being lowered, as a result of "corkscrewing" of the bit, is entirely unrestricted and consequently the otherwise existing hazard of unscrewing a joint in the drill string is eliminated.

When the drill string has been lowered the length of the added stand, the pipe slips are set and the weight of the drill string is transferred to the slips by slightly lowering the hook structure. This allows the spring 20 to expand and raise the hook body. In the absence of the positioning device, if the hook body should have drifted from its initially oriented position as a result of rotation of the pipe during lowering, it would be necessary for the floor crew to grasp the elevator or links and re-orient the hook body so that the elevator opening faces the next stand of pipe to be picked up from the pipe rack. However, if the hook structure is equipped with a positioning device according to this invention, upon upward movement of the hook body the cam follower roller 52 engages the cam surface 32, whereupon the upward spring force produces a torsional component causing the roller to move along the upwardly inclined cam surface and into its initial position. The hook body and elevator are thus automatically re-oriented into proper position for engaging another stand of pipe.

Adjustment of the predetermined oriented position of the hook body and elevator to accommodate varying rig conditions may be quickly and easily effected while the hook structure is unloaded, by rocking the actuator 82 downwardly to disengage the locking member 56 from the teeth 54 on the collar 36. The hook body 8, shank 6 and collar 36 may then be rotated the desired amount while the follower ring 40 is held against rotation by the engagement of the roller 52 with the cam

surface 32. The locking member 56 is then re-engaged with the collar 36 to lock the follower ring 40 in its new position.

It will be observed by reference to Figure 2 that the uppermost portion of the cam surface 32 is provided with a shallow arcuate depression or recess 84, and that the roller 52 has slight clearance with the wall of this recess. This clearance exists because of the fact that further upward movement of the hook body and shank is prevented by engagement of the upper surface of the shank collar 36 with the lower end of the housing 2. By reason of this clearance the roller 52 and its supporting elements are relieved of the upward spring thrust when in this position. Also, by reason of this clearance a slight freedom of oscillation of the hook body is permitted before the roller engages the cam surface. This is considered desirable in order to permit the elevator to oscillate slightly to accommodate itself to the pipe stands while being applied thereto.

Although in the embodiment of the invention above described the cam surface 32 is associated with the housing 2 or other main supporting member and the cam follower is associated with the hook body or other load-carrying member, it will be appreciated that this arrangement may be reversed by mounting the cam follower on the housing and providing the cam surface on the spring-supported load-carrying sub-assembly. It will also be apparent that in lieu of providing for angular adjustment of the cam follower about the axis of the shank into various selected positions, the cam sleeve 34 on which the cam surface 36 is formed may alternatively be angularly adjustable relative to the hook element on which it is mounted. An example of this alternative construction is shown in the embodiment illustrated in Figures 7 to 10, inclusive.

In the embodiment of the invention shown in Figures 1 to 6, inclusive, and described above, the torsional force required to rotate the load-carrying hook element and the elevator into its predetermined oriented position is derived from the hook relief spring, and such rotation occurs during relative axial movement between the load-carrying and supporting elements of the hook structure. The invention is also susceptible of being incorporated in hook structures which do not incorporate relief springs and in which there is no relative axial movement between the conventional elements thereof. An example of this is shown in Figures 7 to 10, inclusive.

Referring to those figures, the hook structure illustrated therein is typical of the type employed when running well production tubing into and out of wells. In such operations the string of tubing is broken down into stands and racked in the derrick or in the mast of the pulling unit in much the same manner as with drill pipe. Hence the same advantages accrue from the use of a positioning device on such a hook structure. As shown, the hook structure comprises generally a supporting member 102 having a bail portion 104 for attaching it to a traveling block, and having an upwardly facing annular shoulder 106 forming a seat for a bearing 108. The load-carrying member comprises a hook body 110 provided with an integral shank 112 the upper portion of which is threaded to receive a nut 114 which is supported on the bearing 108, thus rotatably supporting the hook body 110 by the supporting member 102.

In this embodiment of the invention a cam sleeve 116 is associated with the supporting member 102 and has a downwardly facing cam surface 118 formed thereon. A cam follower roller 120 is associated with the hook body 110, being journaled on a pin 122 carried by a roller support 124. In this instance the cam action is provided by a vertical spring 126 interposed between the roller support 124 and the hook body and constantly urging the roller upwardly into engagement with the cam surface 118. The major portion of the

roller support is of hollow cylindrical form and is telescoped within an upwardly facing recess formed in the hook body, as by drilling the body or, as shown, by welding or otherwise securing a sleeve 128 to the side of the hook body.

It will be apparent that with this arrangement any rotation of the hook body from the position shown will result in compression of the spring 126 as the roller 120 moves downwardly along the inclined cam surface 118. The upward force exerted by the spring 126 develops, by the coaction of the roller 120 and the cam surface 118, a torsional component of force tending to rotate the hook body back to its initially oriented position. Hence upon release or subsidence of the opposing torsional force the hook body automatically returns to its initial position. It will be noted that unlike the previous embodiment, the hook body is urged always to its initially oriented position whether loaded or unloaded. In this embodiment of the invention it is more convenient to provide for variation of the predetermined orientation of the hook body by mounting the cam sleeve 116 for angular adjustment about the axis of the shank 112, and to provide releasable locking mechanism between the sleeve and the supporting member 102. The sleeve may be journaled on the supporting member and supported against upward or downward movement relative thereto by a combined radial and thrust bearing consisting of bearing elements 130 confined between complementary bearing races 132 and 134 in the sleeve and supporting member. The bearing elements may be inserted into the bearing race through a filler opening 136 (Figures 7 and 10) closed by a plug 138.

The cam ring 116 may be releasably locked against rotation by locking mechanism such as a locking member 140 pivotally mounted by a pivot pin 142 in a recess in the cam ring. The locking member may be provided with teeth 144 (Figure 9) adapted to be moved into or out of engagement with any one of a selected group of teeth 146 formed on the supporting member 102. A plunger 148 and a compression spring 150 are mounted in a bore in the locking member, the protruding end of the plunger being beveled on opposite sides and being adapted to ride over a boss 152 on the cam ring as the locking member is rocked about its axis. In this manner the locking member is yieldably retained in either locking or released position. The pivot pin 142 is keyed to the locking member and extends through the wall of the recess to the exterior of the cam ring, an actuator lever 154 being secured to the protruding end of the pivot pin to enable an operator to manipulate the locking member.

When it is desired to change the oriented position of the hook body the rotation lock is released by raising the actuator lever 154, and upon turning the hook body the engagement of the roller 120 with the cam surface 118 causes the cam ring 116 to turn with the hook body. Upon assuming the desired position the rotation lock is manipulated to locking position by depressing the lever 154.

In the embodiment shown in Figures 11 and 12 a different type of cam and follower is incorporated in a hook structure of the type illustrated in Figures 7 to 10, inclusive. In this embodiment the cam 160 is of the radial cam type, providing a peripheral cam surface 162 which is eccentric with respect to the axis of the hook shank 164. For simplicity, the cam is shown as an integral part of the supporting member 166, although it will be understood that if preferred it may be formed as a separate member adjustably mounted on the supporting member, or on the hook body 168 in which case the cam follower would be mounted on the supporting member.

In this instance the cam follower comprises a roller 170 journaled on the free end of an arm 172 which is pivotally supported at its other end on a vertical pivot pin 174 secured to the hook body 168. A torsion spring

176 encircles the pivot pin 174, the upper end of the spring abutting a lug 178 formed on the arm 172 and the other end of the spring abutting a lug 180 formed on the hook body. The arm 172 is thus biased inwardly by the spring to press the roller into engagement with the cam surface 162.

Upon rotation of the hook body out of the position shown, force exerted by the spring 176 and acting through the roller 170 and the cam surface 162 develops a torsional moment of force about the axis of the hook shank, tending to rotate the hook body back to its original position.

It will be observed that as in the embodiment shown in Figures 1 to 6, inclusive, a shallow arcuate recess 84 is formed at the neutral point of cam surfaces 118 and 162 respectively of the embodiments shown in Figures 7 to 10 and Figures 11 and 12. In the latter two cases, however, the rollers 120 and 170 engage the walls of the respective recesses and thus yieldably retain the hook body in a predetermined oriented position with substantially no play. It will be apparent, however, that if some slight freedom of movement of the hook body to either side of the neutral point is desired, this may be rendered possible by lengthening the recesses 84 and providing therein a non-camming surface of the desired length, over which the roller may travel without deflecting the spring. Such freedom of movement could also be obtained by providing a stop means for the roller support 124 or arm 172.

From the foregoing description of several forms which this invention may assume, and illustrating its application to two different types of hook structures, it will be apparent that it is applicable to various types of hook structures which may vary widely in construction so long as they provide for rotation of the load-carrying member relative to the supporting member. Various forms of cams may be employed, and the arrangement whereby the predetermined orientation of the load-carrying member may be changed may assume various forms. While in each of the embodiments illustrated the cam is of the constant-angle type, it will be understood that variable-angle cams may be employed and thus vary the ratio of the spring force to the torsional component of force acting on the load-carrying member.

It is to be understood, therefore, and it will be apparent to those skilled in the art, that other modifications and changes may be made without departing from the essence of the invention, and it is intended to cover herein all such modifications and changes as are embraced within the true scope and spirit of the appended claims.

I claim:

1. A hook structure for use in raising or lowering well pipe or rods comprising, in combination: a supporting member having means for connecting said hook structure to raising and lowering means; a load-carrying member rotatively supported by said supporting member and having means for suspending a load therefrom; cooperating cam elements carried respectively by said members; and means urging one of said cam elements toward the other cam element to cause said elements to bias said load-carrying member into a predetermined oriented position relative to said supporting member.

2. A hook structure comprising in combination: a supporting member; a load-carrying member rotatively supported by said supporting member; cooperating cam elements carried respectively by said members; means urging one of said cam elements toward the other cam elements whereby said elements may coast to bias said load-carrying member about its axis of rotation into a predetermined oriented position relative to said supporting member; one of said elements being adjustable relative to its respective member about the rotative axis of said load-carrying member; and means for releasably securing said adjustable element in different adjusted positions whereby to provide a plurality of selective prede-

termined oriented positions of said load-carrying member.

3. A hook structure comprising the combination of: a supporting member; a load-carrying member rotatively supported by said supporting member; cooperating cam elements carried respectively by said members; spring means urging one of said cam elements toward the other cam element whereby said cam elements may coast to cause said spring means to exert a force tending to rotate said load-carrying member into a predetermined oriented position relative to said supporting member; one of said elements being adjustable relative to its respective member about the rotative axis of said load-carrying member; and means for releasably securing said adjustable element in different adjusted positions whereby to provide a plurality of selective predetermined oriented positions of said load-carrying member.

4. A hook structure for use in raising or lowering well pipe or rods comprising, in combination: a supporting member having means for connecting said hook structure to raising and lowering means; a load-carrying member rotatively supported by said supporting member and having means for suspending a load therefrom; a cam element carried by said supporting member and having a cam surface thereon; a cam follower element carried by said load-carrying member and engageable with said cam surface; and means urging one of said elements toward the other element in a direction to exert a force tending to maintain said load-carrying member in a predetermined oriented position relative to said supporting member.

5. A hook structure comprising the combination of: a supporting member; a load-carrying member rotatively supported by said supporting member; a cam element carried by said supporting member and having a cam surface thereon; a cam follower element carried by said load-carrying member and engageable with said cam surface; means urging one of said elements toward the other in a direction to exert a force tending to maintain said load-carrying member in a predetermined oriented position relative to said supporting member; one of said elements being adjustable relative to its respective member about the rotative axis of said load-carrying member; and means for releasably securing said adjustable element in different adjusted positions whereby to provide a plurality of selective predetermined oriented positions of said load-carrying member.

6. In a hook structure, the combination of: a supporting member; a load-carrying member carried by said supporting member for rotation relative thereto and for limited longitudinal movement relative thereto between first and second longitudinally spaced positions; resilient means interposed between said members yieldingly urging said load-carrying member toward said first position and being yieldable to permit longitudinal movement of said load-carrying member toward said second position; and cooperating elements on said members operable to prevent relative rotation between said members when said load-carrying member is in said first position, said elements being rendered ineffective to prevent said rotation upon movement of said load-carrying member into said second position.

7. A hook structure as set forth in claim 6, wherein said cooperating elements coast to insure return of said load-carrying member to a predetermined oriented position with respect to said supporting member during movement of said load-carrying member from said second position to said first position.

8. A hook structure as set forth in claim 7, wherein one of said elements is angularly adjustable relative to its associated member about the axis of rotation of said load-carrying member to vary said predetermined oriented position.

9. In a hook structure, the combination of: a supporting member; a load-carrying member carried by said supporting member for rotation relative thereto and for

limited longitudinal movement relative thereto between first and second longitudinally spaced positions; resilient means interposed between said members yieldingly urging said load-carrying member toward said first position and being yieldable to permit longitudinal movement of said load-carrying member toward said second position; and cooperating cam elements comprising a cam and a cam follower, one associated with each of said members, said cam elements coacting during movement of said load-carrying member toward said first position, in the event of relative rotation between said members when said load-carrying member is in said second position, to develop from the stored energy in said resilient means a torsional component of force acting between said members to rotate said load-carrying member into a predetermined oriented position with respect to said supporting member when said load-carrying member assumes said first position.

10. A hook structure for use in raising or lowering well pipe or rods comprising, in combination: a supporting member having means for connecting said hook structure to raising and lowering means; a load-carrying member rotatively supported by said supporting member and having means for suspending a load therefrom; one of said members including a housing and the other member including a shouldered shank axially slidable and rotatable in said housing; a compression spring interposed between the shank shoulder and the housing for resisting axial movement of said shank relative to said housing in one direction, said spring being compressible to permit such movement; and cooperating cam elements comprising a cam and a cam follower, one associated with said housing and the other associated with said shank, said cam elements coacting during expansion of said spring, in the event of relative rotation between said shank and housing, to cam said housing and shank into predetermined oriented relation when said spring is fully expanded.

11. A hook structure as set forth in claim 10, wherein said cam elements are ineffective to prevent relative rotation between said housing and said shank when said spring is fully compressed.

12. A hook structure comprising the combination of: a supporting member; a load-carrying member rotatively supported thereby; a pair of cooperating cam elements comprising a cam and a cam follower, one carried respec-

tively by each of said members; spring means acting between one of said cam elements and its respective member and urging said one cam element toward the other cam element; said cam elements coacting to cause said spring means to exert a torsional component of force biasing said load-carrying member about its rotative axis into a predetermined oriented position relative to said supporting member in the event of prior departure of said member from said predetermined oriented position.

13. A hook structure comprising the combination of: a supporting member; a load-carrying member rotatively supported thereby; cooperating cam elements carried respectively by said members; spring means acting between one of said cam elements and its respective member and urging said one cam element toward the other cam element; said cam elements coacting to cause said spring means to exert a torsional force biasing said load-carrying member about its rotative axis into a predetermined oriented position relative to said supporting member in the event of prior departure of said member from said predetermined oriented position; one of said elements being adjustable relative to its respective member about the rotative axis of said load-carrying member; and means for releasably securing said adjustable element in different adjusted positions whereby to provide a plurality of selective predetermined oriented positions of said load-carrying member.

14. A hook structure as set forth in claim 12, wherein said cam includes a cam surface concentric with respect to the rotative axis of said load-carrying member and inclined with respect to a plane normal to said axis, and wherein said cam follower is movable in a direction substantially parallel to said axis.

15. A hook structure as set forth in claim 12, wherein said cam includes a cam surface eccentric with respect to the axis of rotation of said load-carrying member, and wherein said cam follower is movable in a direction substantially normal to said axis.

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