

Aug. 24, 1965

S. W. LONG

3,202,446

HOOK POSITIONER

Filed Jan. 15, 1963

2 Sheets-Sheet 1

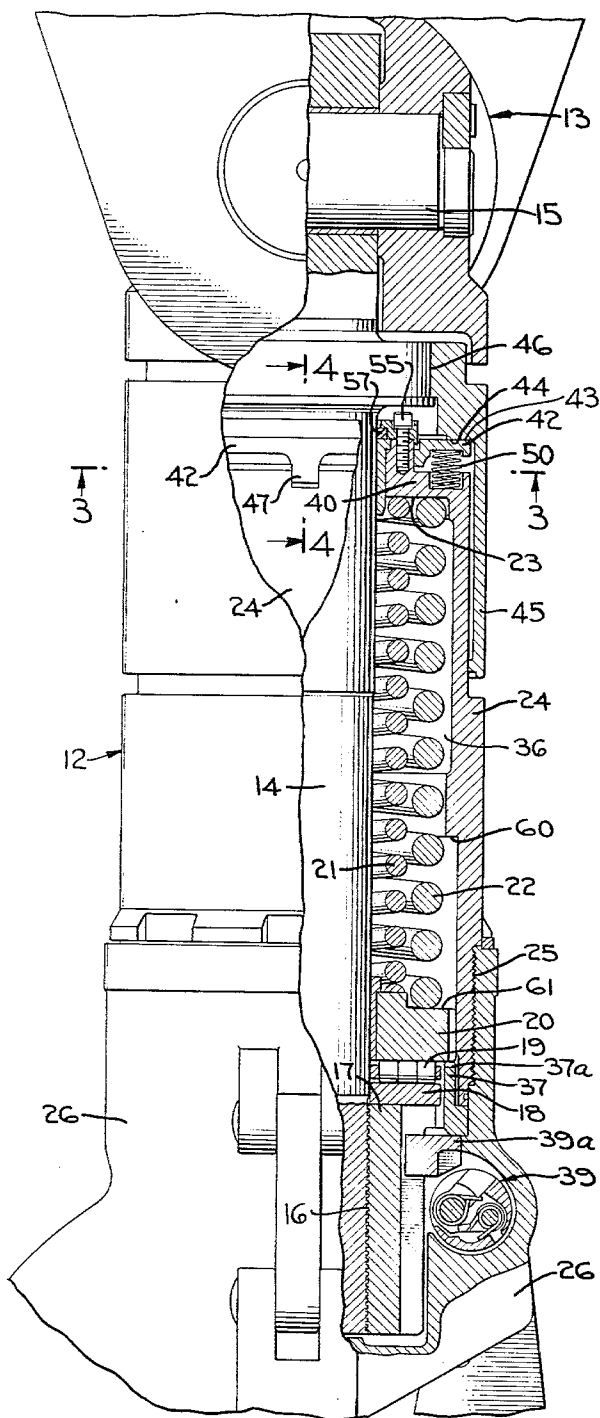


FIG. 2.

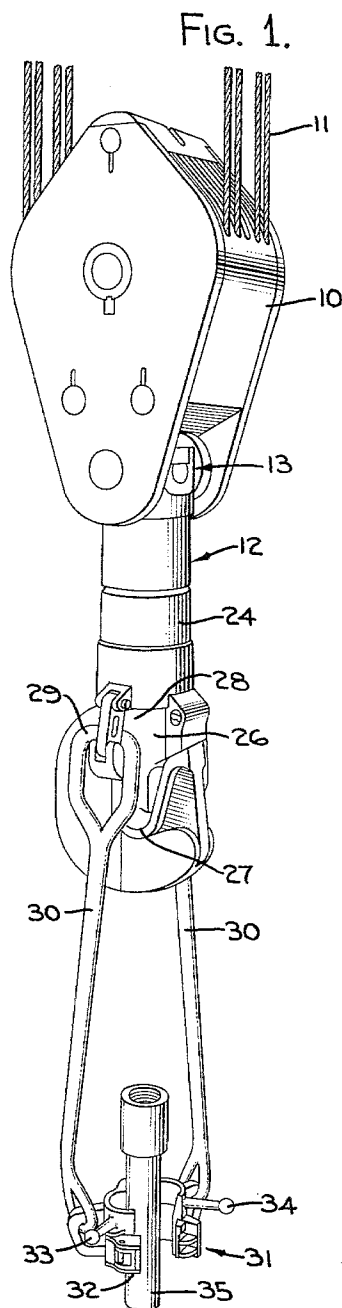


FIG. 1.

INVENTOR.
SPENCER W. LONG

BY

Lyons & Lyons
ATTORNEYS.

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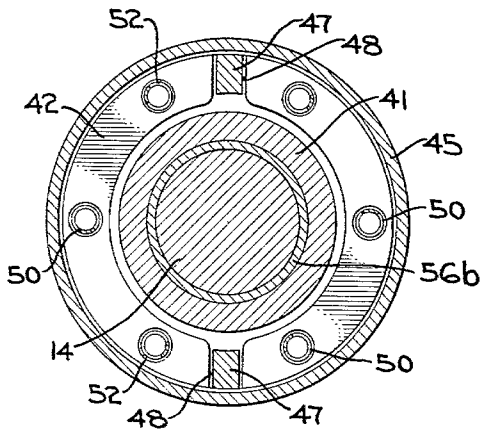


FIG. 3.

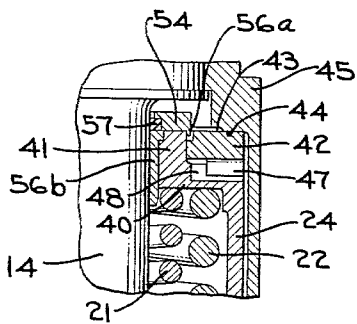


FIG. 4.

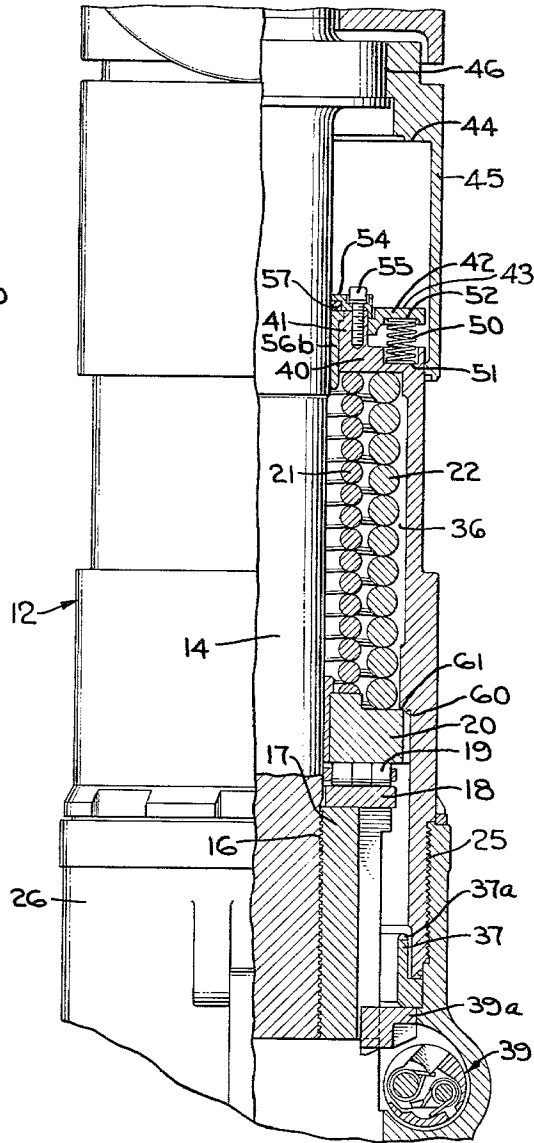


FIG. 5.

INVENTOR.
SPENCER W. LONG
BY *Lyons & Lyons*
ATTORNEYS.

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3,202,446

HOOK POSITIONER

Spencer W. Long, Inglewood, Calif., assignor to Armco Steel Corporation, Middletown, Ohio, a corporation of Ohio

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6 Claims. (Cl. 294—82)

This invention relates to apparatus for drilling oil, gas and other wells and is particularly directed to improvements in the hook assembly which forms a part of the apparatus for suspending the drill pipe. The hook assembly is commonly suspended by the traveling block, and is constructed to provide a support for the swivel and for the elevator links. The swivel is employed to support the rotating drill pipe while the bit is on bottom, and the elevator links are used with a split collar or clamp, known in the art as an elevator, for raising and lowering the drill pipe when making a round trip to replace the bit. The elevator and elevator links are also used in handling casing after the well has been drilled.

In the operation of coming out of the hole, the drill pipe is raised and uncoupled section by section, and in this operation the elevator is clamped around an upper portion of a drill pipe section and then the entire string of drill pipe is raised by means of the hook assembly, elevator links and elevator. When the hook and traveling block approach the upper end of their travel with respect to the derrick or mast, the upward motion of the traveling block is arrested and the drill pipe string is supported on the rotary table by means of wedge slips. An upper section of the drill pipe above the wedge slips is disconnected by uncoupling threaded connections, and the upper section of drill pipe is lifted by means of a spring within the hook, and the drill pipe section is then swung aside and rested on end on the derrick floor. The elevator is then opened, that is, disconnected, from the upper end of the pipe section, and is lowered by means of the traveling block, hook assembly, and elevator links to a position near the derrick floor where it is manually engaged with the next pipe section. This process is repeated as the drill pipe string is raised from the hole and uncoupled section by section.

When the bit has been brought to the surface and replaced by a new bit on the lower end of the drill string, the drill string is reinstalled into the hole by coupling the threaded connections and lowering it section by section. In this operation the elevator is closed about the upper end of one of the sections or stands of the drill pipe resting upright on the derrick floor, and then the stand is coupled by threads to the next lower stand in the string of drill pipe. The weight of the drill string is then transferred to the elevator by lifting a short distance to remove the wedge slips. The drill string, including the new stand, is then lowered until the elevator approaches the location of the derrick floor. Wedge slips are then reinserted in the rotary machine slip bowl to support the drill pipe string. The elevator is then opened to disconnect it from the drill pipe string, and it is raised upward through the derrick or mast until the elevator approaches the upper end of one of the drill pipe stands which is to be connected into the string. The elevator is closed manually by an operator positioned high in the derrick or mast, and, in order to save time, this manual closing of the elevator is done "on the fly" with the elevator moving upward as the operator closes it around the pipe stand. It is highly desirable that the handles for the elevator doors be oriented properly to facilitate closing by the derrick man. If, for example, the open side of the elevator should be facing away from the derrick man, considerable delay would be encountered while

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the derrick man turns the elevator, elevator links, and hook to close the elevator around the drill pipe stand.

The elevator is properly oriented by a member of the drilling crew on the derrick floor just prior to raising the unloaded hook, elevator links, and elevator to pick up another drill pipe stand. The present invention relates to improved apparatus for maintaining the hook, elevator links, and elevator in desired orientation, so that the elevator is properly placed for maximum efficiency of closing by the derrick man.

It is not practicable to rely on the friction torque developed between the contacting faces of the relatively rotatable parts of the hook assembly by the shank springs because the magnitude of such friction torque varies over too wide a range. This variation is caused by variation in weights of the elevator and elevator links, as well as by commercial tolerances on the shank spring rates and lengths. If too much friction torque is present, the member of the drilling crew on the derrick floor is unable to manually orient the elevator, elevator links, and hook to the desired position. If too little friction torque is present, the oriented parts may drift to an undesirable position before they reach the position of the derrick man.

The principal object of this invention is to provide a novel device for frictionally restraining the rotation of the hook whenever it is free of the load of the drill pipe string.

Another object of this invention is to provide such a device which is effective to maintain any desired orientation of the hook while moving from the lowest to the highest operating position with respect to the derrick or mast, and yet which offers substantially no resistance to the turning of the drill string while it is being lowered into the hole.

Another object is to provide a hook assembly having means for substantially eliminating the normal friction torque between the hook parts when unloaded, and also having means for producing a substantially constant friction torque of the magnitude required for maintaining the hook parts in desired rotational position.

Other and more detailed objects will appear hereinafter.

In the drawings:

FIGURE 1 is a perspective view showing a traveling block, hook assembly, elevator links, elevator, and the upper end of a section of pipe;

FIGURE 2 is a side elevation partly broken away and partly in section, showing details of construction of the hook assembly embodying this invention;

FIGURE 3 is a transverse sectional view taken substantially along lines 3—3 shown in FIGURE 2;

FIGURE 4 is a sectional detail taken substantially along lines 4—4 shown in FIGURE 2; and

FIGURE 5 is a side elevation partly in section showing the device in loaded condition.

Referring to the drawings, the traveling block generally designated 10 is suspended in the derrick or mast (not shown) by means of the cable 11, and this traveling block may support the hook assembly 12 in any convenient fashion. A self-aligning connection, generally designated 13, is preferably of the type shown in my prior Patent No. 2,980,400.

The hook assembly 12 includes the stem 14, which is suspended from the pin 15 forming a part of the connection 13. At its lower end the stem 14 is provided with threads 16 (FIGURE 5) which engage nut 17. A bearing assembly including a lower race 18, roller elements 19 and an upper race 20, rests on the nut 17. Inner and outer coil compression springs 21 and 22 rest on the upper race 20 and encircle stem 14 within the annulus 36. The

upper ends of the springs 21 and 22 engage the downward-facing abutment 23, provided on the upper portion of the tubular housing 24.

The housing 24 is connected by threads 25 to the load-carrying hook body 26. This body 26 is provided with a primary notch 27 to receive the swivel bail (not shown) and is also provided with secondary notches 28 to receive the upper ends 29 of the elevator links 30. The elevator 31 is pendently supported on the links 30 and is provided with a laterally opening door 32. Handles 33 and 34 are used for manually closing the door 32 about a section of drill pipe 35. From this description it will be understood that the weight of the drill pipe 35, elevator 31, elevator links 30, hook body 26, and housing 24, rests on the springs 21 and 22 through the downward-facing abutment 23. The bearing assembly 18, 19, and 20 permits rotation of all the parts just mentioned with respect to the non-rotary stem 14.

Upward movement of the hook body 26 and housing 24 under force of the springs 21 and 22 is limited by engagement of the stop ring 37 with the under side of the upper bearing race 20, which is free to rotate. Accordingly, no rotational friction force is developed between the lower end of the shank 14 and the hook body 26. Slots 37a may be provided in the upper end of the stop ring 37 to facilitate passage of lubricant.

Means are provided for supplying an essentially constant frictional restraining torque impeding rotation of the hook body 26 and housing 24 when the parts are free of axial load. As shown in the drawings, this means includes an axial extension 41 on the flange 40, and this extension 41 is encircled by an annular friction plate 42 having an upper surface 43 frictionally engaging a downward-facing shoulder 44 provided on the hood 45. The hood is fixed with respect to the nonrotary stem 14 by means of the shrink fit along the cylindrical surfaces 46. The friction plate 42 is provided with downward-extending lugs 47, which project into slots 48 provided in the flange 40 on the housing 24. The inter-engagement of the lugs 47 and slots 48 prevents relative turning movement of the friction plate 42 with respect to the housing 24, while permitting limited axial movement therebetween.

Coil compression springs 50 are axially positioned and circumferentially spaced and are mounted in aligned pockets 51 and 52 provided in the flange 40 and friction plate 42, respectively. These springs 50 serve to apply a lifting force to the friction plate 42, to hold it in friction contact with the downward-facing shoulder 44 when the parts are in unloaded position as shown in FIGURES 1, 2, and 4. In this position the plate 42 frictionally restrains rotation of the hook body 26 and housing 24 with respect to the nonrotary stem 14.

A retainer ring 54 encircles the upper end of the extension 41 and is secured thereto by threaded fastenings 55. The retainer ring 54 has a lip 56a, which overlies a portion of the friction plate 42, and, therefore, when the flange 40 moves downward under load away from the shoulder 44 as shown in FIGURE 5, the springs 50 lift the friction plate 42 upward into contact with the retainer ring 54. The retainer ring also serves to hold in place the bushing 56b and seal ring 57, which slide on the outer surface of the non-rotary stem 14. It will be observed from a consideration of FIGURE 5 that the friction plate 42 is inoperative whenever the load on the hook is sufficient to move the flange 40 downward away from the shoulder 44.

The rotation lock assembly includes the pawl mechanism 39 and lock ring 39a, which are constructed as shown in my prior Patent No. 2,980,400 and form no part of the present invention.

In operation, the hook assembly 12 is employed in the conventional manner, using the elevator links 30 and elevator 31 for raising and lowering drill pipe or casing. In the operation of going into the hole, the drill pipe is first supported on the slips in the rotary machine. (not

shown) and the elevator 31 is disconnected therefrom by opening the door 32 and moving the elevator laterally away from the pipe. The friction plate 42 is at this time in contact with the nonrotary shoulder 44, because no drill pipe weight is applied to the hook assembly. An operator on the derrick floor may grasp the elevator links 30 to turn the hook body 26 and housing 24 to the proper orientation to facilitate subsequent closing of the elevator 31 around a stand of drill pipe by the derrick man. The friction plate 42 contacts the shoulder 44 to resist turning movement of the hook body 26 and housing 24, and, therefore, the relatively rotatable parts of the hook assembly 12 remain in the selected orientation while the elevator is being raised from the position near the derrick floor to a position adjacent the derrick man. After the drill pipe stand has been coupled to the remaining portion of the drill pipe string, the weight of the hook assembly, elevator links, elevator, and drill pipe string compresses the springs 21 and 22 to bring the shoulder 60 and 61 into contact, as shown in FIGURE 5. The friction plate 42 moves away from the shoulder 44, and hence unrestricted rotation of the hook body 26 and housing 24 is permitted; this allows turning movement of the pipe string as it is lowered into the hole.

Having fully described my invention, it is to be understood that I am not to be limited to the details herein set forth, but that my invention is of the full scope of the appended claims.

I claim:

1. In a device of the class described, the combination of: a stem member, a housing member encircling the stem member to define an annular space therebetween, means including a thrust bearing supporting one member on the other for relative rotary movement, said means also including a compression spring mounted within said annular space to permit relative telescopic movement of said members, one of the members having a shoulder, a friction plate mounted on the other member and adapted to frictionally engage said shoulder, means preventing rotary movement of the friction plate with respect to said other member, a retainer element on the latter said member permitting limited axial movement of said friction plate with respect to said other member, bias means interposed between said friction plate and said member for moving said friction plate in a direction to contact said shoulder, said friction plate engaging said retainer element upon telescopic movement of said members in a direction to compress said spring.

2. In a device of the class described, the combination of: a stem member, a housing member encircling the stem member to define an annular space therebetween, means including a thrust bearing supporting one member on the other for relative rotary movement, said means also including a compression spring mounted within said annular space to permit relative telescopic movement of said members, the stem member having an annular shoulder, a friction plate mounted on the housing member and adapted to frictionally engage said shoulder, means preventing rotary movement of the friction plate with respect to the housing member, a retainer element on the housing member permitting limited axial movement of said friction plate with respect thereto, bias means interposed between said friction plate and said housing member for moving said friction plate in a direction to contact said shoulder, said friction plate being moved by said retainer element away from said shoulder by telescopic movement of said members in a direction to compress said spring.

3. In a hook assembly of the class described, a combination of: a vertical stem member, a housing member encircling the stem member to define an annular space therebetween, an element on the lower end of the stem member providing a support, means including a thrust bearing on said support mounting the housing member on the stem member for relative rotary movement, said

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means also including a compression spring mounted within said annular space to permit downward axial movement of said housing member, the stem member having an annular downward facing shoulder, a friction plate mounted on the housing member and adapted to frictionally engage said shoulder, lugs on the friction plate engaging slots in the housing member to prevent relative rotary movement of the friction plate and housing member, a retainer element on the housing member permitting limited axial movement of said friction plate with respect to said housing member, springs interposed between said friction plate and said housing member for moving said friction plate in a direction to contact said shoulder, said friction plate being moved by said retainer element away from said shoulder by downward movement of said housing member.

4. In a hook assembly of the class described, the combination of: a load-carrying hook member, a supporting member, means mounting said hook member upon said supporting member, said means including a thrust bearing assembly and a coil compression spring encircling a portion of one of said members, whereby said hook member may have axial and rotary movement relative to said supporting member, said thrust bearing assembly having an element engaged by said coil compression spring, means on one of said members engageable with said element of said thrust bearing assembly to limit extension of said spring when said hook member is not loaded, one of said members having a shoulder, a friction plate mounted on the other member and movable relative thereto for frictional engagement with said shoulder to inhibit free rotation of said hook member, said friction plate and said shoulder separating axially upon axial movement of said hook member in a direction to compress said spring.

5. In a hook assembly of the class described, the combination of: a load-carrying hook member, a supporting member, means mounting said hook member upon said supporting member, said means including a thrust bearing assembly and a coil compression spring encircling a portion of one of said members, whereby said hook member may have axial and rotary movement relative to said supporting member, said thrust bearing assembly having

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an element engaged by said coil compression spring, means on one of said members engageable with said element of said thrust bearing assembly to limit extension of said spring when said hook member is not loaded, means providing a shoulder on the supporting member, a friction plate mounted on the hook member and movable relative thereto for frictional engagement with said shoulder to inhibit free rotation of said hook member, said friction plate and said shoulder separating axially upon axial movement of said hook member in a direction to compress said spring.

6. In a hook assembly of the class described, the combination of: a load-carrying hook member, a supporting member, means mounting said hook member upon said supporting member, said means including a thrust bearing assembly and a coil compression spring encircling a portion of one of said members, whereby said hook member may have axial and rotary movement relative to said supporting member, said thrust bearing assembly having an element engaged by said coil compression spring, means on one of said members engageable with said element of said thrust bearing assembly to limit extension of said spring when said hook member is not loaded, means providing a shoulder on the supporting member, a friction plate mounted on the hook member for frictional engagement with said shoulder to inhibit free rotation of said hook member, means permitting limited axial movement of said friction plate with respect to said hook member but preventing relative rotation therebetween, bias means acting to move said friction plate axially toward said shoulder, said friction plate and said shoulder separating axially upon axial movement of said hook member in a direction to compress said spring.

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ROBERT B. REEVES, *Acting Primary Examiner.*

ANDRES H. NIELSEN, SAMUEL F. COLEMAN,
Examiners.