

Oct. 12, 1943.

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2,331,341

DRILLING HOOK

Filed Jan. 9, 1942

3 Sheets-Sheet 1

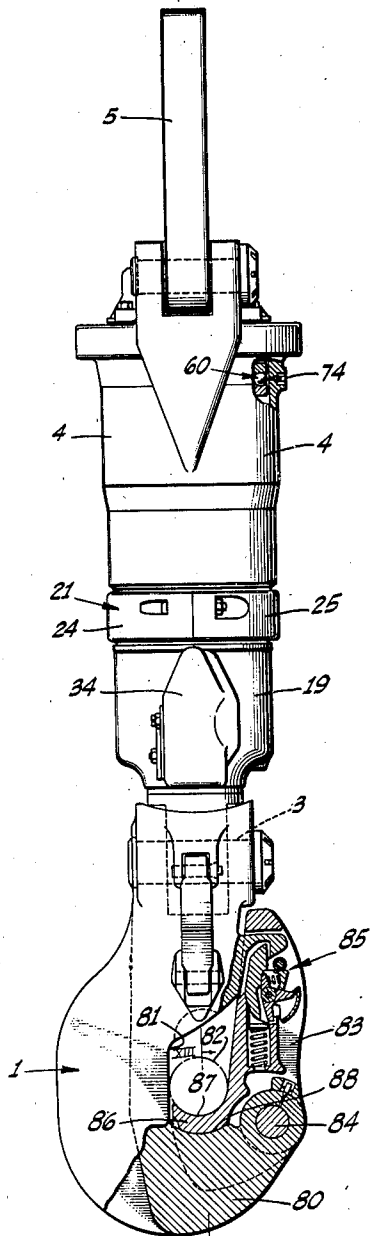


Fig. 1.

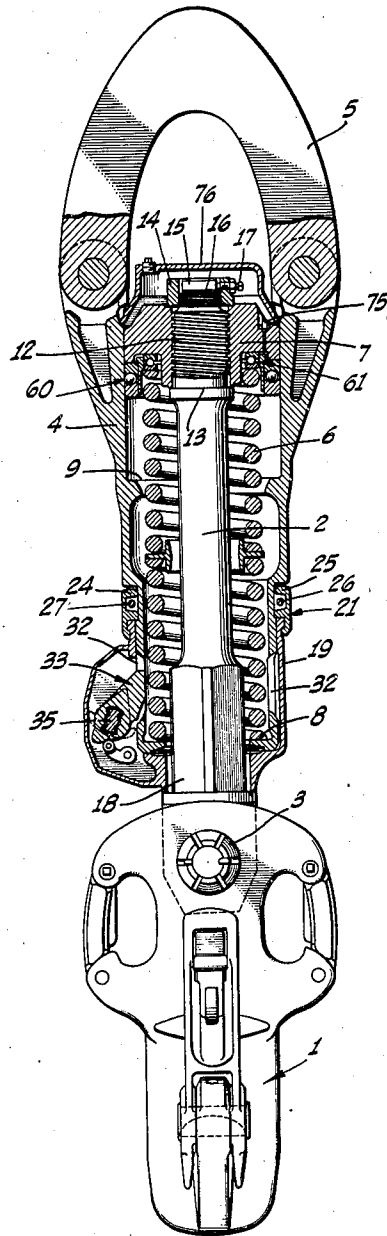


Fig. 2.

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3 Sheets-Sheet 2

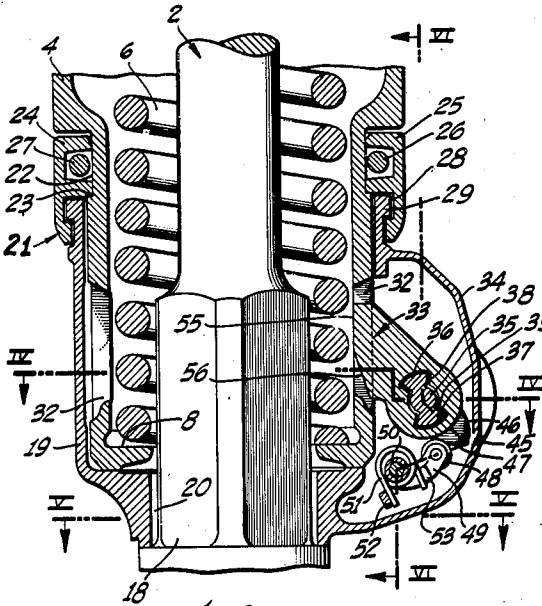


Fig. 3.

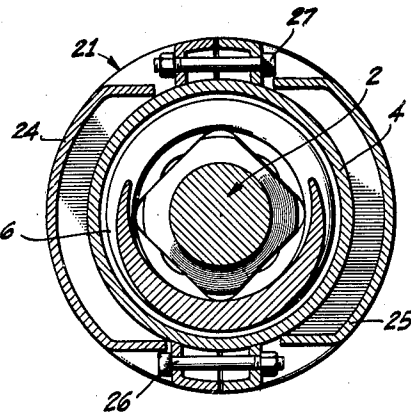


Fig. 7.

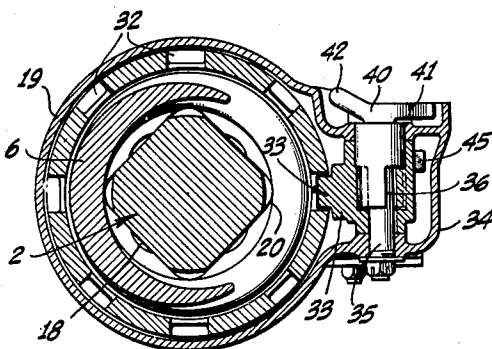


Fig. 4.

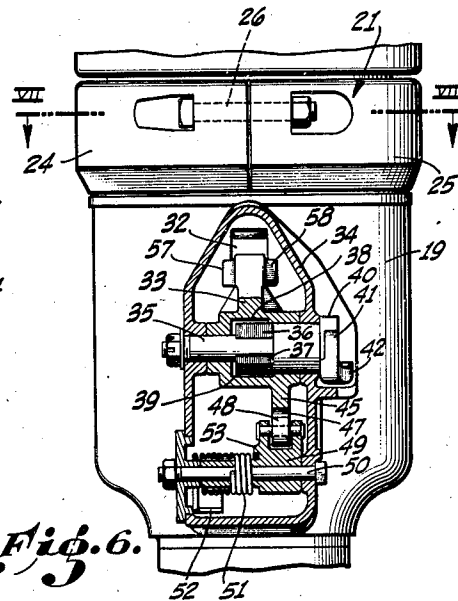


Fig. 6.

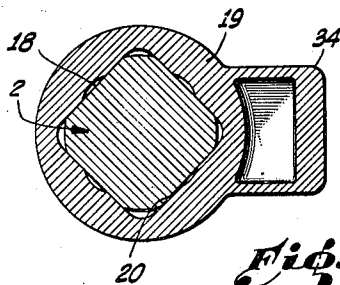


Fig. 5.

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3 Sheets-Sheet 3

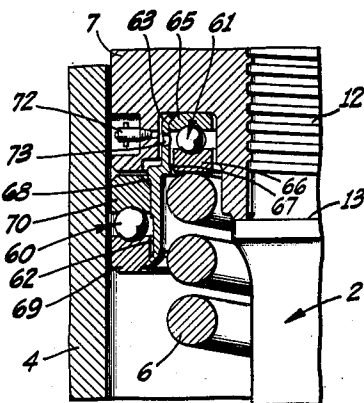
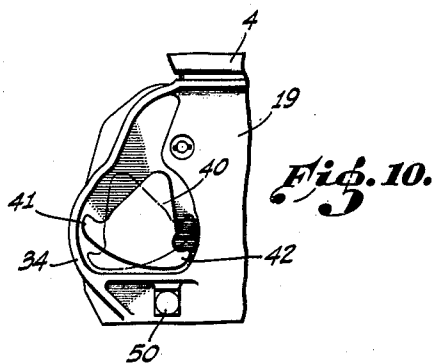
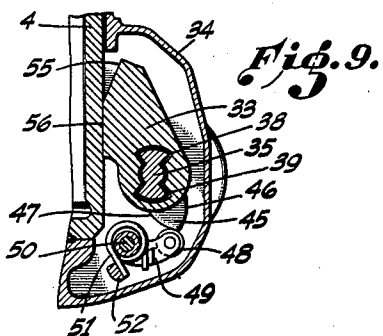
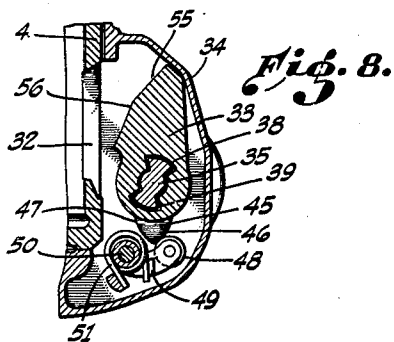


Fig. 11.

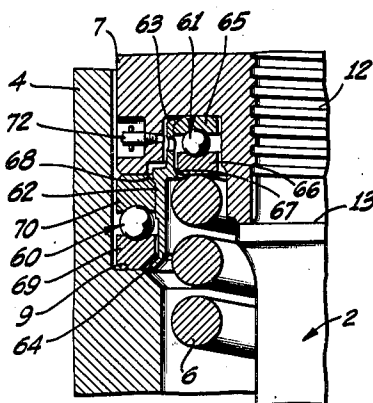
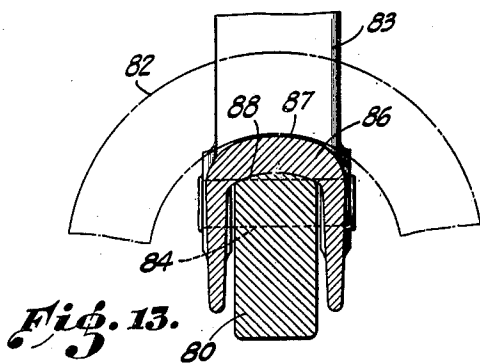


Fig. 12.



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UNITED STATES PATENT OFFICE

2,331,341

DRILLING HOOK

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Application January 9, 1942, Serial No. 426,196

7 Claims. (Cl. 294—83)

This invention relates generally to drilling hooks and particularly to spring hooks such as are used in rotary well drilling operations.

A general object of the invention is to provide a hook of exceptionally rugged and durable construction and embodying improved features designed to better withstand the severe service to which rotary and casing hooks are subjected.

Another object is to provide an improved construction for releasably locking the hook member of a spring hook against rotation with respect to the supporting housing.

Other objects and advantages will be apparent from the following detailed description of one embodiment of the invention, reference being had to the accompanying drawings wherein:

Fig. 1 is an elevation of a complete hook assembly embodying the invention;

Fig. 2 is a view, partly in elevation and partly in section, taken at right angles to Fig. 1;

Fig. 3 is an enlarged fragmentary longitudinal sectional view of the central portion of the hook, showing the swivel lock sleeve rotated through 180° from the position shown in Fig. 2;

Fig. 4 is a transverse section taken on line IV—IV of Fig. 3;

Fig. 5 is a transverse section taken on line V—V of Fig. 3;

Fig. 6 is an elevation of the portion of the hook shown in Fig. 3, as viewed from the right-hand side of the latter figure, with parts broken away on line VI—VI of Fig. 3;

Fig. 7 is a transverse section taken on line VII—VII of Fig. 6;

Figs. 8 and 9 are views showing the swivel locking member in two different positions from that illustrated in Fig. 3;

Fig. 10 is a fragmentary elevational view of the swivel lock housing, as viewed from the right of Fig. 6;

Figs. 11 and 12 are enlarged fragmentary sectional views of the upper portion of the hook, illustrating the swivel bearing in two positions; and

Fig. 13 is a longitudinal section taken on line XIII—XIII of Fig. 1.

Referring to the drawings, and particularly to Figs. 1 and 2, the invention has been shown as incorporated in a hook comprising generally a hook body 1 pivotally connected to the lower extremity of a shank 2 by a pivot pin 3, the shank 2 being yieldably supported in a housing 4. A yoke or bail 5 is connected to the upper end of the housing for connecting the hook to the usual traveling block. In accordance with usual prac-

tice, the shank 2 is yieldably supported in the housing by a coil compression spring 6 interposed between a nut 7 threaded to the upper end of the shank and an inwardly projecting shoulder 8 at the lower end of the housing. Downward movement of the shank and hook, as the spring is compressed under load, is limited by a stop shoulder 9 formed in the housing 4.

It will be observed that the nut 7 is threadedly connected to the shank 2 by a relatively coarse left-hand thread 12, preferably of the modified Acme type, although it will be appreciated that any other type of thread may be used. The hook is most frequently rotated in clockwise direction, as viewed from above, as when making up the joints between sections of drill pipe or casing, and hence the provision of a left-hand thread tends to cause the nut to tighten instead of loosen during rotation. The thread is of the straight type, rather than tapered, and the nut is made up against a shoulder 13 on the shank 2. The nut 7 is securely locked in engagement with the shoulder 13 by a lock nut 14 which is threadedly connected to a reduced extension 15 on the shank, by a relatively fine left-hand thread 16 of less pitch than the thread 12. The lock nut is made up tightly against a flat shoulder on the upper surface of the nut 7, and, due to the difference in pitch of the two threads, a powerful wedging effect is obtained. However, as a further safeguard against inadvertent loosening of the lock nut, a set screw 17 is preferably threaded in the lock nut and engages the shank extension 15 above the threads 16.

A sturdy and compact swivel locking arrangement has been provided, for releasably locking the hook body 1 and the shank 2 against rotation with respect to the housing 4, without interfering with the axial reciprocation of the shank in the housing. Referring to Figs. 3 to 10 inclusive, it will be observed that the lower portion 18 of the shank 2 is enlarged and formed of square cross-section, as shown most clearly in Figs. 4 and 5. The square portion 18 is slightly longer than the maximum axial travel of the shank, and affords a splined connection between the shank and a lock sleeve 19. As seen most clearly in Fig. 5, the lower portion of the sleeve 19, below the stop shoulder 8 on the housing 4, is provided with a square opening 20 closely fitting the square portion of the shank. The sleeve extends upwardly around the lower cylindrical portion of the housing 4, and is rotatably supported thereon by a split clamp ring 21 (Figs. 3, 6 and 7).

As shown in Fig. 3, the outer wall of the hous-

ing 4 is recessed inwardly at 22, providing an upwardly facing shoulder 23 for supporting the clamp ring 21 against downward movement. The clamp ring comprises a pair of semi-circular segments 24 and 25, secured together about the housing 4 by bolts 26 and 27. The lower portion of the clamp ring is cut away to provide an undercut recess 28, and the upper extremity of the lock sleeve 19 is provided with a similarly shaped annular rib 29 housed within the recess 28 and providing a rotatable interlocking connection between the lock sleeve and the clamp ring. The lock sleeve is thus mounted on the housing 4 for rotation with the shank 2 and hook body 1, but is constrained against axial movement with respect to the housing.

In order to releasably lock the shank 2 against rotation with respect to the housing 4, a releasable locking connection is provided between the housing and the lock sleeve 19. As shown most clearly in Fig. 4, a plurality of circumferentially spaced slots 32 are formed in the lower portion of the housing 4, and a locking member 33 is pivotally mounted on and enclosed within a laterally projecting housing 34 formed integral with the lock sleeve 19, the member 33 being movable radially into or out of engagement with a selected one of the slots 32. The locking member is suitably keyed to a rock shaft 35 journaled in the housing 34, and for this purpose the central portion of the rock shaft is provided with a pair of oppositely extending ribs or keys 36 and 37 which engage similarly shaped keyways 38 and 39 in the hub of the locking member. To enable the rock shaft 35 to be manually oscillated about its axis, and thus move the locking member into or out of engagement with one of the slots 32, one end of the rock shaft projects through the wall of the housing 34 and is provided with an enlarged head 40 on which are formed a pair of hook-shaped projections 41 and 42, as shown in Fig. 10. When the locking member 33 is in the locking position shown in Fig. 3, the head 40 assumes the position indicated in solid lines in Fig. 10. If it is desired to move the locking member to its released position (Fig. 8), a downward pull is exerted on the projection 41 by means of the usual "shepherd's hook" provided for that purpose, to rock the shaft in counter-clockwise direction, as viewed in Fig. 10, the head 40 then assuming the dotted line position indicated in the latter figure. Similarly, a downward pull on the projection 42 causes the locking member to move from released to locked position.

A spring toggle mechanism is associated with the locking member 33 for yieldably maintaining the locking mechanism in either locking or released position. As shown most clearly in Figs. 3, 6, 8 and 9, a double-faced cam 45 is formed integral with and projects outwardly from the hub of the locking member, and is provided with oppositely directed cam faces 46 and 47. One cam face or the other is adapted to be selectively engaged by a roller 48 mounted on the free end of a rocker arm 49 journaled on a pin or bolt 50 mounted in the housing 34 and extending parallel to the rock shaft 35. The rocker arm is yieldingly urged in a counter-clockwise direction, as viewed in Figs. 3, 8, and 9, by a torsion spring 51 having one end thereof engaging an abutment 52 on the housing 34 and the other end engaging an abutment 53 on the rocker arm.

Thus, when the locking member is in the locking position shown in Fig. 3, the roller 48 engages

the cam face 47 and urges it in counter-clockwise direction, thus yieldingly maintaining the locking member in this position. As the rock shaft 35 is rotated to move the locking member to its released position, the cam face 47 forces the rocker arm downwardly against the action of the spring 51, until the roller passes the apex of the cam and engages the other cam face 46. Thereupon the rocker arm urges the locking member in clockwise direction, moving it into the released position indicated in Fig. 8.

It will be observed, with particular reference to Figs. 3 and 9, that the locking member 33 is provided with two angularly disposed faces 55 and 56 on the side thereof facing the housing 4. The upper face 55 is so disposed that, when the locking member engages one of the slots 19, the face 55 extends parallel to the axis of the shank 2 and flush with the inner wall of the housing, a pair of laterally extending wings 57 and 58 (Fig. 6) being provided on the locking member to limit its inward movement. The lower face 56 is angularly disposed with respect to the upper face 55, so that if the locking member should be rocked inwardly but should not align with one of the slots 19, the face 56 will extend parallel to the outer wall of the housing 4 when it engages the latter, as indicated in Fig. 9. It will be observed that in this position of the locking member, the roller 48 engages the inner cam face 47 and urges the locking member toward locking position. It will therefore be evident that if the hook body 1 and shank 2 are then rotated slightly, to align the next adjacent slot 32 with the locking member, the latter will automatically snap into the slot under the action of the spring 51. This arrangement dispenses with the necessity of maintaining a downward manual pull on the projection 42 while the hook is being rotated to align a slot 32 with the locking member.

It will be understood by those familiar with rotary and casing hooks that the spring 5 is only of sufficient strength to support a single stand of drill pipe, and that when the entire drill string is suspended from the hook the spring compresses and allows the hook body and shank to descend until the stop shoulder 9 is engaged, thus transferring the load directly from the shank nut 7 to the stop shoulder. It has been customary to interpose an anti-friction bearing between the shank nut and the stop shoulder, to provide free swivelling of the hook body under full load when this is desired. In prior constructions, the same bearing has also been so arranged as to be interposed between the upper extremity of the spring and the lower face of the shank nut, in order to provide free swivelling of the shank and nut with respect to the spring. Freedom of rotation of the hook body, shank and shank nut is especially desirable when the hook is under light load, inasmuch as it is customary to rotate the hook manually in order to turn the elevator suspended therefrom into a predetermined oriented position while it is near the derrick floor, each time a stand of pipe is added to the drill string during the operation of running the drill string into the well. The provision of a single bearing interposed between the shank nut and both the spring and the stop shoulder is, however, objectionable for the following reasons:

During the drilling operation, the weight of the drill string is transferred from the hook shank to the housing through the shank nut and the bearing. The hook is locked against ro-

tation during drilling, and hence for long periods of time each of the bearing balls or rollers occupies a fixed position with respect to the bearing races, and the vibration and the gyratory motion transmitted to the hook from the drill string during drilling often causes the bearing members to wear grooves or indentations in the bearing races. It is obvious that the presence of a series of indentations in the bearing races interferes with the freedom of rolling action when it is desired to rotate the hook, and this is particularly noticeable when the hook is rotated manually to orient the elevator.

In order to overcome the aforementioned difficulty, we have provided a bearing construction incorporating a main bearing 60 (Figs. 11 and 12) interposed between the shank nut 7 and the stop shoulder 9, and an auxiliary bearing 61 interposed between the shank nut and the upper end of the spring 6. Since the spring 6 is always maintained under an initial pre-compression, the auxiliary bearing is retained thereby in engagement with the nut 7 and moves vertically with the nut during compression and expansion of the spring. It is also deemed preferable to mount the main bearing in such a manner that it also moves vertically with the nut. To accomplish this, a dual bearing retainer 62 is provided, and it will be observed that this retainer not only maintains the races and balls of each bearing in assembled relation, but also serves to support the main bearing 60 from the auxiliary bearing 61.

The retainer comprises a one-piece structure which may be pressed to shape from sheet stock, with the upper and lower extremities initially straight to permit the auxiliary bearing 61 to be inserted from the upper end and the main bearing 60 to be applied from the lower end. After the bearings are assembled on the retainer, the upper edge is rolled inwardly to form a lip 63, and the lower edge is rolled outwardly to form a lip 64, to securely retain the bearings in place.

Attention is directed to the fact that the retainer is supported by the upper race 65 of the bearing 61, and that a clearance is provided between the lower race 66 of that bearing and an upwardly facing inclined shoulder 67 on the retainer. In a similar manner, the spacing of the lower outwardly bent lip 64 and the downwardly facing shoulder 68 on the retainer is such as to provide clearance between one of these shoulders and the respective race 69 or 70 of the bearing 60. These clearances are exaggerated in Figs. 11 and 12 of the drawings, for illustrative purposes, and in actual practice may be only a few thousandths of an inch.

When the spring 6 is expanded and the main bearing 60 is out of contact with the stop shoulder, as indicated in Fig. 11, the bearing is supported solely by the lower lip 64 of the retainer. During rotation of the hook body, shank and shank nut under these circumstances, the main bearing 60 obviously will rotate as a unit with the retainer 62, the nut 7, and the upper race 65 of the auxiliary bearing 61, relative rotation taking place between the races 65 and 66 of the auxiliary bearing. The latter bearing is never loaded in excess of the compression strength of the spring 6, and hence it is not subject to the grooving action which occurs in the main bearing during drilling. It will, therefore, remain in good operating condition for a long period of time, provided it is properly lubricated.

In Figs. 11 and 12, a lubricant fitting 72 is pro-

vided in the nut 7, to which access is had upon removal of a suitable closure plug (not shown) in the housing 4. A series of openings 73 are provided in the retainer 62 in the horizontal plane of the fitting 72, for admitting lubricant to the bearing 61. Lubricant from this fitting will also work downwardly into the main bearing 60, and, as shown in Fig. 1, the main bearing may also be separately lubricated through a fitting 74 in the housing. In addition to or in lieu of the fitting 72, a lubricant fitting 75 (Fig. 2) may be provided in the nut 7, to which access is obtained by removal of the cover plate 76 which closes the upper end of the housing 4.

Referring to Fig. 12, wherein the parts are shown in the position they assume when the hook is heavily loaded, it will be observed that the main bearing is now supported on the stop shoulder 9, and that clearance is provided between the lower lip 64 of the retainer and the lower race 69 of the bearing. The upper race 70 engages the shoulder 68 on the retainer, but this is not objectionable inasmuch as these members rotate as a unit with the nut 7 and the upper race 65 of the auxiliary bearing. The main bearing provides free swiveling between the shank nut and the stop shoulder 9, while the auxiliary bearing enables the nut to rotate freely with respect to the spring 6.

Referring now to Figs. 1 and 13, it will be observed that the hook body 1 includes a bill 80 providing a recess 81 for receiving a load-sustaining member such as a swivel bail, indicated in dotted lines at 82. The recess is adapted to be closed by a locking arm 83 pivoted to the bill at 84, and suitable latching mechanism, indicated generally at 85, is provided for releasably latching the arm in closed position. It is preferable that the locking arm be automatically closed as the swivel bail or other load-carrying member is inserted into the recess 81, and for this purpose a closing finger 86 is formed integral with the locking arm and projects inwardly therefrom so as to be engaged by the bail 82 as the latter enters the recess 81. As shown most clearly in Fig. 13, the closing finger is of inverted U-shape in cross-section, and extends downwardly along each side of the bill 80 of the hook a sufficient distance to embrace the bill when the locking arm is in open position, thus avoiding the possibility of a member of the drilling crew having his fingers caught between the closing finger and the upper surface of the bill.

The upper surface 87 of the closing finger is convex in the plane of Fig. 13, and preferably conforms to the curvature of the under side of a standard swivel bail of the same capacity as the hook. The lower surface of the closing finger and the upper surface 88 of the bill 80 are also convex in the plane of Fig. 13, and are preferably concentric with the upper surface 87. In the plane of Fig. 1, the surface 87 is concave, preferably conforming to the cross-sectional contour of the swivel bail 82, and the lower surface of the closing finger and the upper surface 88 of the bill are also preferably concave, and concentric with the surface 87. In this manner, the maximum bearing area is provided between the swivel bail and the closing finger, and between the latter and the bill 80.

From the foregoing description of a preferred embodiment of the invention, it will be apparent that a drilling hook has been provided which is of very rugged and durable construction, and in which the features which, in the past, have

proved to be most troublesome, have been so designed as to eliminate the most frequent sources of trouble.

It is to be understood, of course, that the specific details of construction shown and described are subject to modification in various respects, and that the invention is not limited to such details but is of the full scope of the appended claims.

We claim:

1. In a hook structure, the combination of a housing member having a central bore, a shank member mounted in the bore for longitudinal and rotary movement relative thereto, a hook member supported by one of said members, resilient means housing the shank member in the bore of the housing member, and means for releasably locking the shank member against rotation relative to the housing member, said means comprising a sleeve member rotatably supported by the housing member and having a slidable and non-rotatable connection with the shank member, and a locking member mounted on the sleeve member and movable into and out of locking engagement with the housing member.

2. In a hook structure, the combination of a housing member having a central bore and a pair of supporting shoulders longitudinally spaced along the axis of the bore, a shank member mounted in the bore for longitudinal and rotary movement relative thereto and having a head at one end thereof, resilient means interposed between one of said shoulders and said head, bearing means between the other shoulder and said head, a sleeve member rotatably supported by the housing member and having a slidable and non-rotatable connection with a portion of the shank member remote from said head, and means for releasably locking the sleeve member against rotation relative to the housing member.

3. In a hook structure, the combination of a housing member having a bore, a shank mounted in the bore for longitudinal and rotary movement relative to the housing member, a sleeve member rotatably supported by the housing member and having a slidable and non-rotatable connection with an integral portion of the shank, a locking member mounted on one of said members and movable into and out of locking engagement with the other member, and means yieldably maintaining said locking member in either locked or released position.

4. In a hook structure, the combination of a housing member having a central bore, a shank mounted in the bore for longitudinal and rotary movement relative to the housing member, said shank having an integral portion of non-circular cross-section, a sleeve member rotatably supported by the housing member and having a non-circular opening therein slidably and non-rotatably receiving the non-circular portion of the shank, and means for releasably locking the sleeve member against rotation relative to the housing member.

5. In a hook structure, the combination of a housing member, a shank member supported thereby for longitudinal and rotary movement relative thereto, a sleeve member rotatably supported by the housing member and having a slidable and non-rotatable connection with the shank member, a locking member carried by the sleeve member and movable into and out of locking engagement with the housing member, and spring toggle means yieldably maintaining the locking member in either locked or released position.

6. In a hook structure, the combination of a housing member, a shank member supported thereby for longitudinal and rotary movement relative thereto, a sleeve member surrounding a portion of the housing member and having a slidable and non-rotatable connection with the shank member, said housing member having an external shoulder, an element supported on the shoulder and supporting the sleeve member for rotation relative to the housing member, and means for releasably locking the sleeve member against rotation relative to the housing member.

7. In a hook structure, a housing member having a central bore, a pair of internal shoulders and an external shoulder on said member, a shank in said bore and having a pair of abutments, resilient means interposed between one of said internal shoulders and one of said abutments, bearing means interposed between the other internal shoulder and the other abutment, an element supported on the external shoulder, a sleeve member supported by said element for rotary movement relative to the housing member and having a slidable and non-rotatable connection with said shank, and means for releasably locking the sleeve member against rotation relative to the housing member.

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