United States Patent

Langowski

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[54] **FLUID TRANSFER APPARATUS FOR WELL PIPE ELEVATOR**

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[21] Appl. No.: **85,594**

[52] **U.S. Cl.**.....**294/82 R,** 294/90, 285/98

[51] **Int. Cl.**.....**F16l 27/00**

[58] **Field of Search**....294/82, 90; 214/2.5; 254/192; 285/96, 98, 190, 275

[56] **References Cited**

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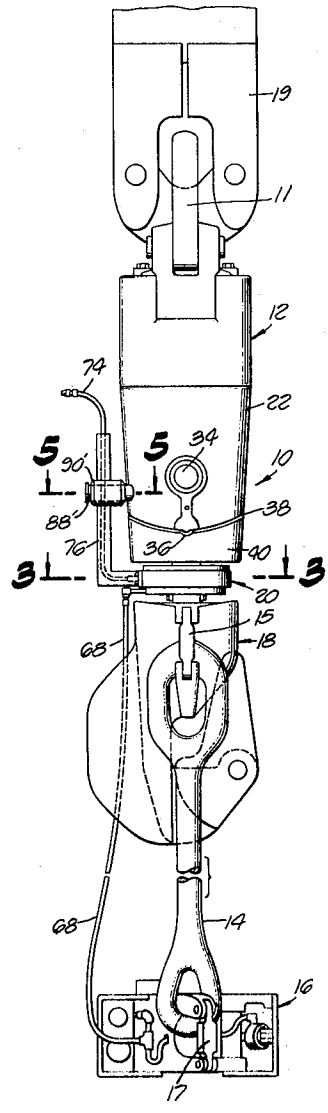
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[57] **ABSTRACT**

Apparatus for conducting pressurized fluid from a hook structure having a swiveling hook to a fluid operated well pipe elevator attached to the swiveling hook with such apparatus being mounted in sheltered and shielded relation with respect to the swiveling hook and the adjacent body of the hook structure.

11 Claims, 5 Drawing Figures



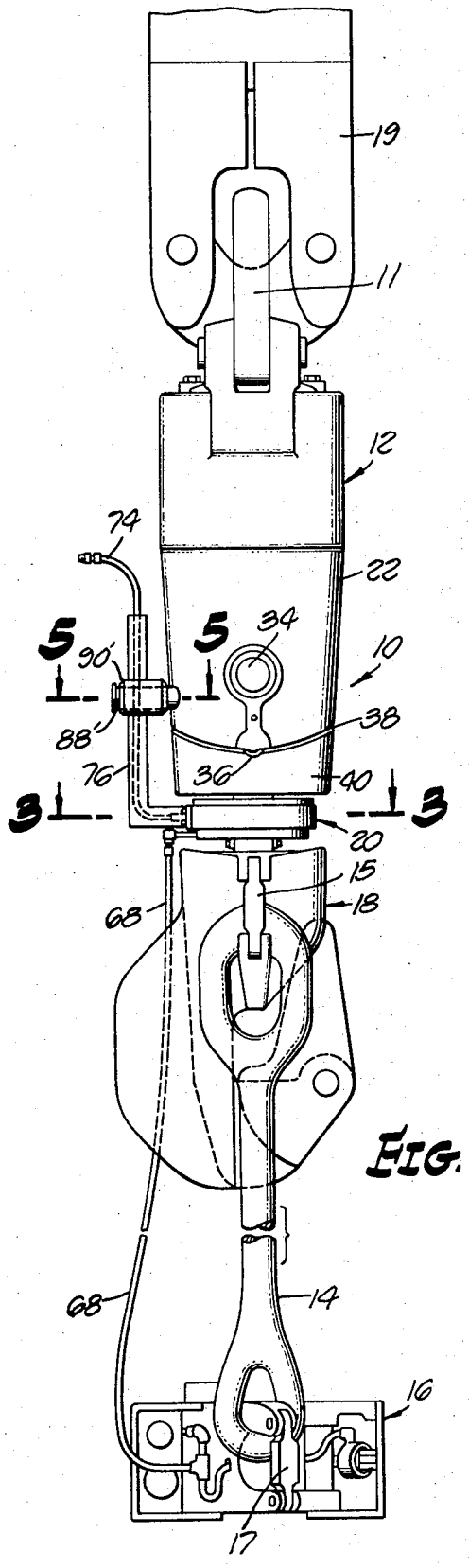


FIG. 1.

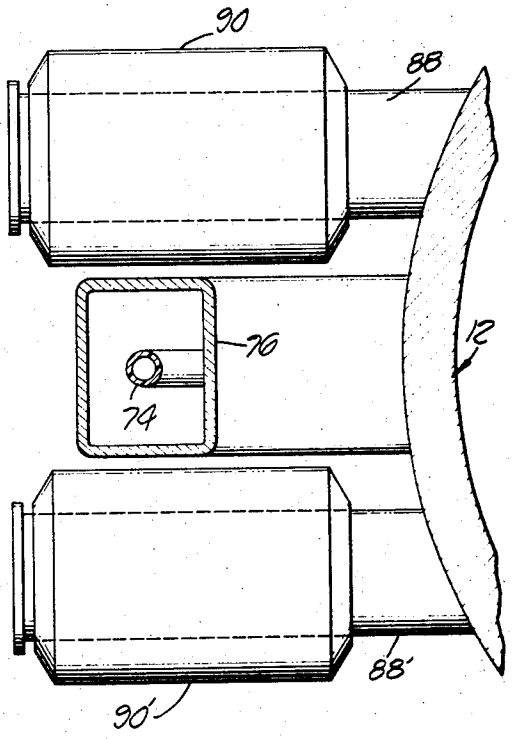


FIG. 5.

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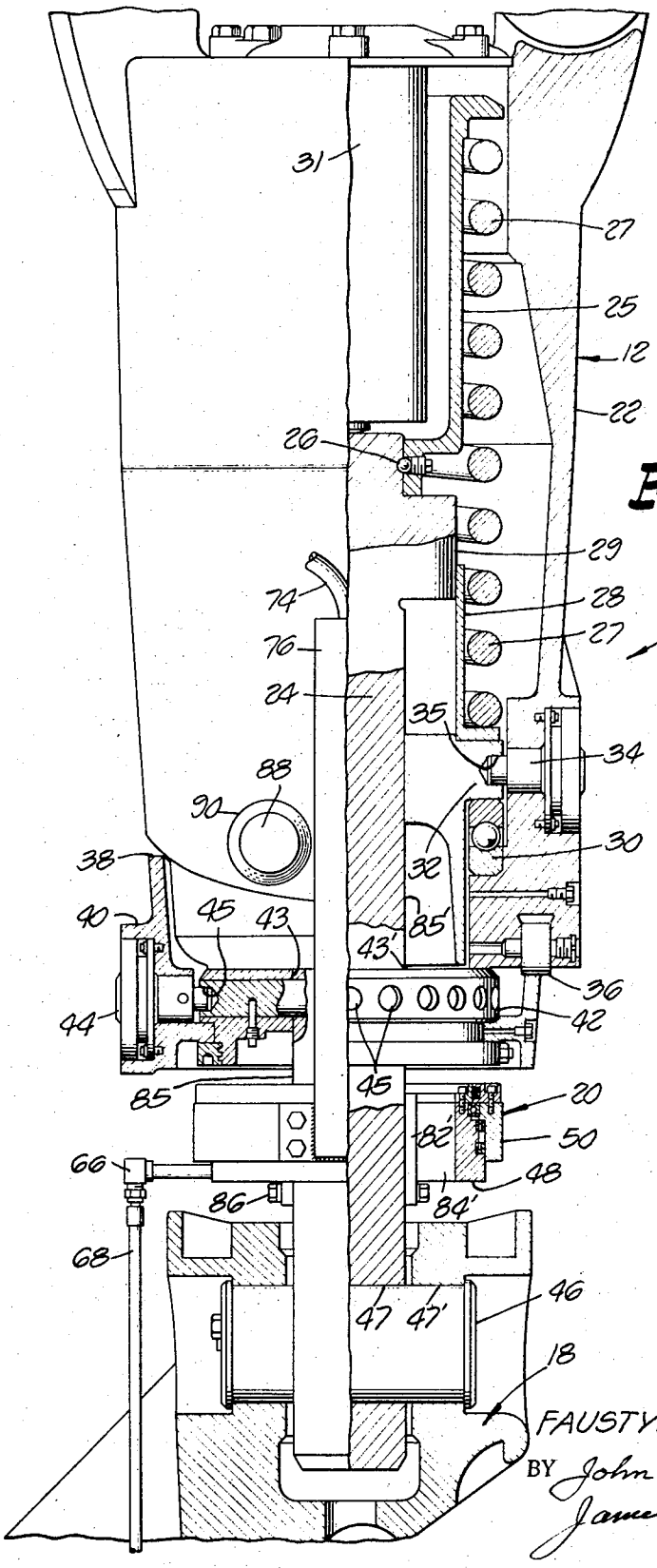
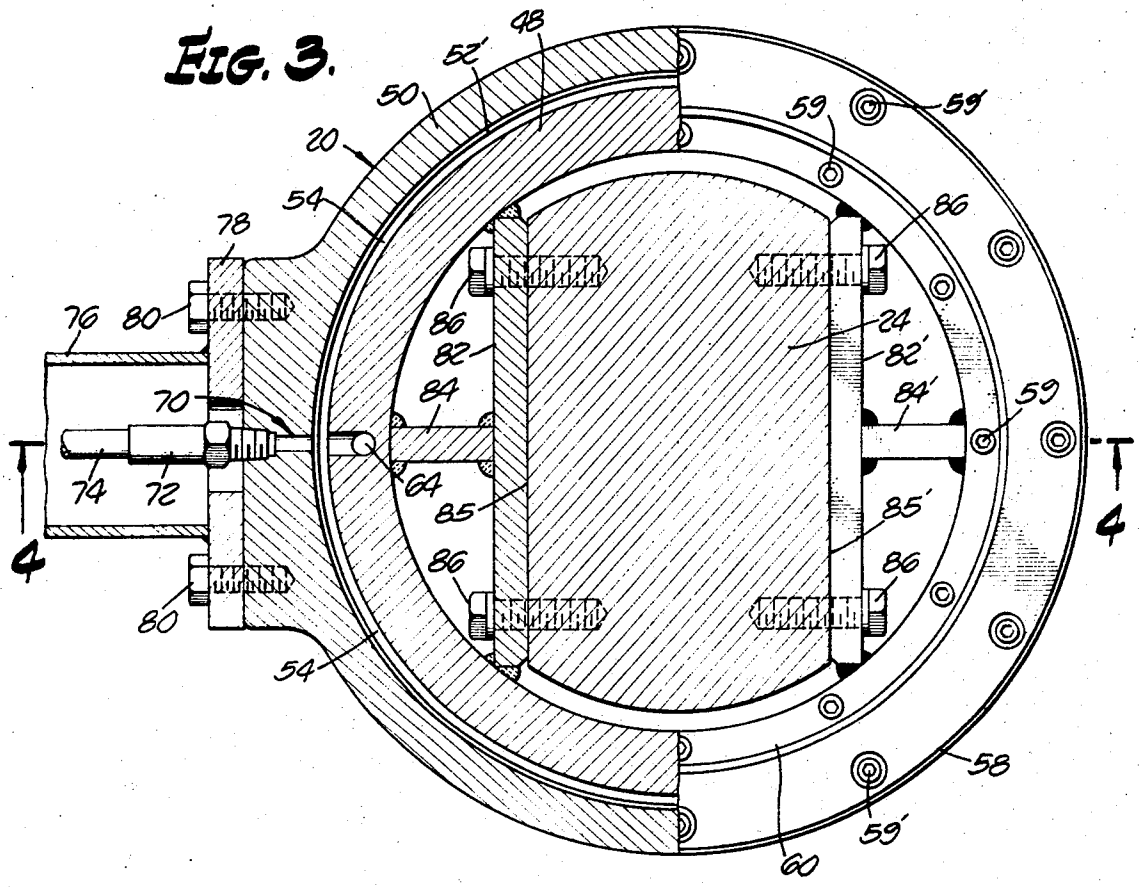


FIG. 2.

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FIG. 3.



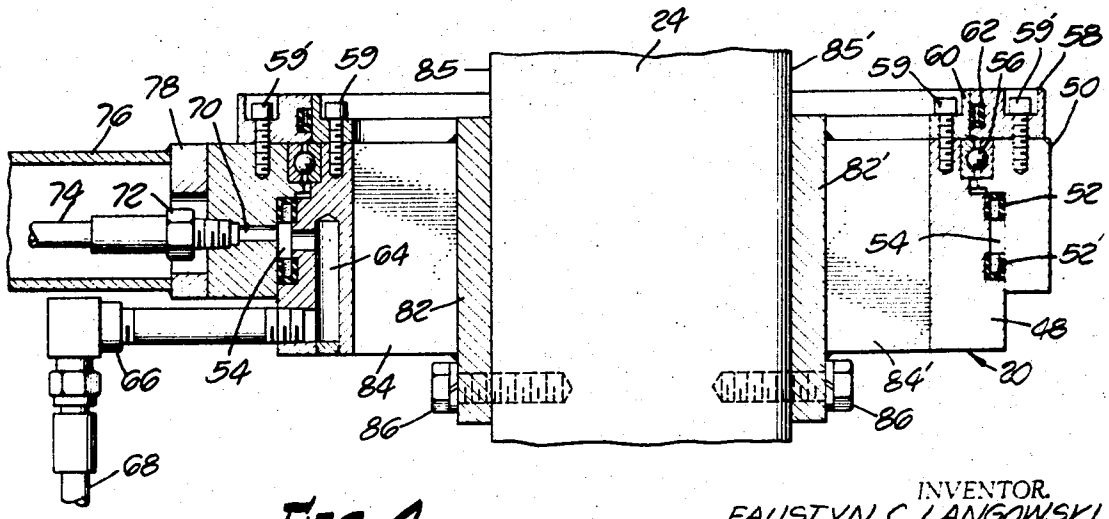


FIG. 4.

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FLUID TRANSFER APPARATUS FOR WELL PIPE ELEVATOR

BACKGROUND OF THE INVENTION

This invention relates to pipe handling equipment and particularly to improved hook and elevator equipment for handling drill pipe in a derrick during the rotary drilling of wells for producing fluids from subterranean earth formations or for injecting fluids into such formations.

In the drilling of such wells the drill string, comprising many joints of drill pipe, is periodically removed from or run into the well bore to change drill bits, to check the inclination of the well bore and for various other purposes familiar to those skilled in this art.

When a string of drill pipe is removed from the well bore it is usually unscrewed in stands or sections of pipe comprising two or three joints of pipe and the stands are placed in racks. When the drill pipe is run into the well bore the stands of pipe are successively screwed to the string of drill pipe and lowered into the well bore. During these operations the drill pipe is supported from an elevator connected by link to a hook structure. The elevator is provided with hinge means to open laterally to release the drill pipe and to shut about the drill pipe in supporting relation.

The hook structure is swiveled to permit rotation of the drill pipe when the drill pipe is raised from or lowered into the well bore and is provided with means to align the open side of the elevator with the drill pipe in the well bore. A suitable hook structure is described in U.S. Pat. No. 2,732,244, issued Jan. 24, 1956.

For more efficient and rapid movement of the drill pipe into the out of the well bore and to conserve manpower, the opening and closing of the elevator about the pipe is desirably accomplished by a source of power and by remote actuation. A suitable elevator actuated by fluid under pressure is described in U.S. Pat. No. 2,695,189, issued Nov. 23, 1954.

In order to provide pressurized fluid to power such a fluid actuated elevator and to obviate the problem of the fluid conductor lines to the elevator becoming tangled and twisted during normal operation of the equipment, a desirable feature for such equipment is the provision of a swiveling fluid manifold permitting transmission of pressurized fluid from the hook structure to the elevator at every arcuate position of the elevator. A suitable swiveling fluid manifold arrangement is described in U.S. Pat. No. 3,479,062, issued Nov. 18, 1969.

While a swiveling fluid manifold such as described above is operable and resolves the difficulties of line entanglement and twisting, the structure is subject to damage from impacts with the drill pipe and other objects in the derrick, particularly where the derrick is mounted on a floating platform which moves and tilts about during drilling operations. Such damage is sometimes sufficient to render the swiveling manifold inoperable, causing a loss of time in drilling operations while repairs are being made. Another difficulty in the use of a swiveling manifold which is mounted around the stationary portion of a hook structure, is that, when built in operable proportions, the diameter of the manifold to its axial length causes more stringent machining tolerances to prevent leakage and galling of the elements of the manifold and causes the swiveling manifold structure to be less sturdy than desirable and more succeptable to damage from impacts with the drill pipe and other objects and appurtenances within the derrick.

SUMMARY OF THE INVENTION

In order to improve and enhance the continuous usage of fluid actuated elevators without requirements of inactive periods for repairs, it is one object of this invention to provide improved means for conducting actuating fluid under pressure to a fluid actuated elevator which will obviate the probability that the fluid conducting means can be damaged or rendered inoperative by impacts with drill pipe or other objects during removal of the stands of drill pipe from the well or during the running of the stands of drill pipe into the well.

Another object of this invention is to provide a swiveling fluid manifold which is rugged in construction and which is not subject to misalignment or galling when in use.

An additional object of this invention is to provide a swiveling fluid manifold which rides with the hook of the hook structure, both axially and arcuately, and thus requires no change in length or position of the fluid conductor between the elevator and the hook except as caused by angular movement of the connecting links between the elevator and the hook.

The invention is embodied in a hook structure having a stationary body and an axially movable and rotatable body with a fluid actuated elevator connected with and movable with the rotatable portion of the hook structure. The improvement comprises: a swiveling fluid conducting manifold having a first element connected in rotatable relation with a second element with the manifold being mounted in recessed and sheltered relation between the stationary body and the rotatable body of the hook structure. One element of the swiveling manifold is connected to be axially movable and rotatable with the rotatable body of the hook structure and the other element of the manifold is connected to be arcuately stationary with respect to the stationary body of the hook structure and axially movable with the rotatable portion of the hook structure. The manifold means includes means to transmit fluid under pressure from a fluid inlet defined in one element of the manifold to a fluid outlet defined in the other element of the manifold during any arcuate fluid position of either element relative to the other element. A fluid conductor is connected from the fluid outlet to the elevator and means positioning the element containing the fluid outlet to an arcuate and axial position corresponding with the position of the rotatable portion of the hook structure and the connected elevator is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a hook structure and elevator arrangement which incorporates the apparatus of this invention.

FIG. 2 is an enlarged view of a portion, partly in longitudinal section, of the arrangement shown in FIG. 1.

FIG. 3 is a transverse sectional view taken along the line 3—3 of Fig. 1 as seen in the direction of the arrows.

FIG. 4 is a longitudinal section taken along the line 4—4 of Fig. 3 as seen in the direction of the arrows.

FIG 5 is a transverse sectional view, partly in plan, taken along the line 5—5 of Fig. 1 as seen an the direction of the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Fig. 1 there is shown a hook structure 10 comprising a hook support body 12 and a hook body 18. Elevator links 14 (only one of two links shown) connect an elevator structure 16 to hook body 18 through connection of links 14 with hook ears 15 and elevator ears 17. Hook structure 10 is supported within a derrick (not shown) by means of a traveling block 19 (partially shown) connected to the hook structure 10 by means of bails 11. Mounted between hook body 10 and hook support body 12 is a swiveling manifold structure 20. As shown, manifold structure 20 is mounted in recessed relation with respect to the lateral dimensions of hook support body 12 and hook body 18 so as to be sheltered from impact with objects moving longitudinally or laterally with respect to hook structure 10.

Referring now to Fig. 2, hook support body 12 is seen to comprise a support housing 22 in which is mounted a hook support shank 24 with a swivel ring 32 interposed in splined relation between shank 24 and housing 22. As seen in FIGS. 2, 3, and 4, shank 24 is formed generally cylindrical with opposing flat surfaces 85 and 85' extending longitudinally over a portion of shank 24 and swivel ring 32 has corresponding flat surfaces within its bore to accommodate the flat surfaces of shank 24 and thereby permit relative longitudinal movement between shank 24 and swivel ring 32 and also to cause corresponding rotation of shank 24 and swivel ring 32. Resilient and longitudinal support for shank 24 is provided by a support spring 27 nested between an upper support sleeve 25 and a lower guide sleeve 28. Support sleeve 25 is connected to shank 24 by means of a retainer ball assembly 26. Guide sleeve 28 encompasses an enlarged cylindrical portion 29 of shank 24 and rests in rigid longitudinal supporting relation with swivel ring 32. Swivel ring 32 is supported in longitudinally rigid and rotatable relation with housing 22 through a support bearing assembly 30. A stop assembly 31 mounted in housing 22 provides rigid longitudinal support for shank 24 in a direction opposite to that provided by support bearing 30. As provided, shank 24 may be rotated within housing 22 and moved longitudinally upon compression of spring 27.

Shank 24 may be limited in arcuate movement, when desired, in relation to housing 22 by means of a shank positioner lock assembly 34 which may extend into a selected one of a group of holes 35 disposed about the outer periphery of swivel ring 32. Positioner lock 34 is locked during drilling operations and at other times at the option of the drilling equipment operator.

As also shown in Fig. 2, shank 24 is connected to a cam ring 40 through a cam positioner nut and collar assembly 42. The positioner nut and collar assembly 42 is connected to cam ring 40 as shown and fixed in preselected arcuate relation to cam ring 40 by means of a cam positioner lock assembly 44 which is radially mounted in cam ring 40 and extends into a preselected one of a multiplicity of holes 45 defined about the outer periphery of positioner assembly 42. A portion of positioner nut and collar assembly 42 has defined thereon flat surfaces 43 and 43' which fit in splined relation with surfaces 85 and 85' of shank 24.

A cam face 38 is defined about the circumference of cam ring 40 which varies in axial dimension from any reference point taken along the axis of cam ring 40, such dimension variation being in preselected relation with different points about the circumference of cam ring 40. As shown in Fig. 2, cam face 38 rides against a cam roller assembly 36 which is mounted in an end of housing 22 with the axis of the cam roller assembly 36 being disposed normal to the axis of housing 22. Upon assembly of support body 12, spring 27 is placed in initial compression which forces the cam roller 36 against cam face 38. As the shank 24 and cam ring 40 are rotated with respect to housing 22, the spring 27 is more or less compressed a distance corresponding to the axial dimension variation of cam face 38 as previously described. Accordingly, if the shank 24 has no restraint against rotation, the compressive force of spring 27 will cause the cam roller assembly 36 to drive cam ring 40 to a predetermined position corresponding to the least axial dimension of cam face 38 from the preselected reference point. The purpose, construction, and general operation of hook support body 12 is further described in previously referenced U.S. Pat. No. 2,732,244.

As seen in Fig. 2, shank 24 is connected to hook body 18 by means of a hook support pin assembly 46 which is fitted through corresponding holes 47 and 47' defined in the shank and hook body. Such construction is common in the art and need not be further described herein.

Referring now to FIGS. 1, 2, 3, and 4, a swiveling manifold structure 20 is mounted on shank 24 in a space defined between hook support body 12 and hook body 18. As further seen hereinafter with reference to the drawing, the manifold structure 20 is of rugged and compact structure and sheltered effectively by the hook support body 12 and body 18 against impacts from objects moving in the vicinity of hook structure 10.

Referring to FIGS. 3 and 4, swiveling manifold 20 is seen to incorporate a circular inner sealing ring 48 which has disposed therein support plates 82 and 82' forming chords across the interior of seal ring 48 and reinforced by radially extending webs 84 and 84' respectively. Plates 82 and 82' and webs 84 and 84' are connected to inner seal ring 48 as by welding, for example. Plates 82 and 82' are rigidly connected to the flat faces 85 and 85' of shank 24 by cap screw assemblies 86 as best shown in Figs. 3 and 4.

Disposed concentrically about the inner seal ring 48 is a circular outer seal ring 50. Seals 52 and 52' interposed between inner seal ring 48 and outer seal ring 50 cooperate to define an annular fluid cavity 54 adapted to contain fluid under pressure through any arcuate position of seal ring 48 with respect to seal ring 50. A swivel bearing assembly 56 is mounted between inner seal ring 48 and outer seal ring 50 in a manner preventing axial or radial movement therebetween yet permitting free arcuate or rotational movement therebetween. Swivel bearing 56 is confined in operational position by means of an inner bearing retainer ring 60 attached to inner seal ring 48 with cap screws 59 and an outer bearing retainer ring 58 attached to

outer seal ring **50** with cap screws **59**. A dust sealing ring **62** is mounted between inner and outer retainer rings **60** and **58** as shown to keep bearing **56** free of deleterious material.

As best seen in Fig. **4**, outer sealing ring **50** has defined therein a radially disposed inlet fluid passage **70** which is in communication with cavity **54**. Inner sealing ring **48** has longitudinally then radially defined therein an outlet fluid passage **64**. With the structure as described, fluid passages **70** and **64** remain in continuous fluid communication through cavity **54** through any relative arcuate position of inner seal ring **48** and outer seal ring **50**.

A fluid inlet conduit **74** is connected into fluid communication with fluid passage **70** through an inlet fitting **72** and a fluid outlet conduit **68** is connected in fluid communication with fluid passage **64** through a fluid outlet fitting **66**. Outlet conduit **68** is connected in fluid communication with elevator structure **16**.

Fluid inlet conduit **74** is enclosed by an angular conduit protector and alignment housing **76**. Housing **76** is rigidly connected to a housing mounting plate **78**, as by welding, which plate in turn is rigidly connected to outer seal ring **50** by means of cap screw assemblies **80**, for example, The construction and disposition of housing **76** and inlet hose **74** is shown in Figs. **1, 3, 4**, and **5**.

Referring to Figs. **1** and **5**, housing **76** is seen to extend laterally from hook structure **10** then longitudinally with respect to hook support body **12** along the side of body **12** in spaced apart adjacent relation. Positioned along each side of housing **76** and connected in parallel relation to housing **22** of support body **12** are cylindrical guide post assemblies **88** and **88'** upon which posts are mounted guide bumpers **90** and **90'** which may be provided of rubber or plastic, for example. The alignment housing **76**, the guide posts **88** and **88'**, the outer seal ring **50** and inner seal ring **48** and the hook support shank **24** all coordinate to comprise means whereby fluid under pressure may be transmitted into conduit **70**, through swiveling manifold **20** and out through conduit **68** to elevator structure **16** while hook body **18** (and elevator structure **16**) is reciprocated and rotated with respect to hook support body **12**. The posts **88** and **88'** serve to fix housing **70** against arcuate movement with respect to hook support body **12** but permit unrestricted longitudinal movement of housing **76** with respect thereto.

From the foregoing description of one embodiment of the invention, it will be apparent that the hook body **18** and the elevator structure **16** may be freely rotated and reciprocated with respect to the hook support body **20** while at all times maintaining a dependable and continuous supply of fluid under pressure through inlet conduit **74**, swiveling manifold **20** and outlet conduit **68** to elevator structure **16** to actuate the elevator structure as desired. It will also be apparent that the hook structure **10** maybe carried by traveling block **19** through various longitudinal and lateral movements with respect to drill pipe and other objects or appurtenances within the derrick with minimal danger of damage to swiveling manifold **20** as might otherwise result from impacts with such objects or appurtenances.

Having fully described one embodiment of the invention herein, it is to be understood that other embodiments could be provided and changes could be made in the construction thereof without departing from the spirit of the invention as described.

I claim:

1. Apparatus including a hook structure having a stationary body mounting an axially movable and rotatable support shank means connected with a rotatable hook body and with a fluid actuated elevator connected to said hook body and movable with said axially movable and rotatable support shank means, wherein the improvement comprises:

a. a circular swiveling fluid conducting manifold having a first element connected in rotatable relation with a second element;

b. said manifold being mounted on said support shank means in axial relation between said stationary body and said rotatable hook body wherein the lateral dimensions of said stationary body and said rotatable hook body are greater than the radial dimensions of said swiveling manifold;

c. means connecting said first element to said stationary body to prevent rotation of said first element with respect to said stationary body and to permit axial movement of said first element with respect to said stationary body; and

d. means connecting said second element to said support shank means to cause axial and rotational movement of said second element corresponding to movement of said rotatable hook body;

e. said fluid manifold provided with means for fluid communication between a fluid inlet means adapted for connection to a source of fluid under pressure and a fluid outlet means connected with said fluid actuated elevator.

2. The apparatus of claim **1** wherein said means connecting said first element to said stationary body comprises a rigid alignment means connected to said first element and extending axially adjacent said stationary body and guide means connected with said stationary body to permit only axial movement of said rigid alignment means.

3. The apparatus of claim **2** wherein said rigid alignment means is provided with means to protect said fluid inlet means in the vicinity of said means for fluid communication.

4. The apparatus of claim **3** wherein said manifold includes an outer sealing ring to comprise said first element, an inner sealing ring to comprise said second element and sealing means interposed therebetween to define said means for fluid communication.

5. The apparatus of claim **4** wherein said inner sealing ring is connected to said support shank means extending axially from said stationary body and said outer sealing ring is connected to a rigid alignment means extending axially adjacent said hook support member and through axial alignment means connected to said hook support member.

6. The apparatus of claim **5** wherein said rigid alignment means is a housing enclosing said fluid inlet means.

7. The apparatus of claim **1** wherein said hook support and said hook body are provided with lateral dimensions sufficient to shield said fluid manifold from impacts with objects moving longitudinally and laterally with respect to said apparatus.

8. Swiveling fluid manifold apparatus adapted to be mounted on a support shank projecting in axially movable and rotatable relation from the stationary body of a hook structure having a rotatable hook body connected to the support shank with the manifold apparatus disposed between the stationary body and the hook body, said manifold apparatus comprising:

a. an inner seal ring adapted for connection to said support shank through support means;

b. an outer ring mounted in rotatable relation around said inner seal ring;

c. sealing means interposed between said inner seal ring and said outer seal ring to define a fluid communication means;

d. fluid inlet means connected through said outer seal ring into said communication means and connected in protected relation by rigid alignment means projecting from said outer seal ring;

e. said alignment means being adapted to fit within guide means connected to said stationary body to permit only axial movement of said alignment means and said outer seal ring with respect to said stationary body; and

f. fluid outlet means connected through said inner seal ring into said communication means and adapted to rotate with said rotatable hook body.

9. The apparatus of claim 8 wherein rigid alignment means project outwardly then axially from said outer ring.

10. The apparatus of claim 9 wherein said rigid alignment means comprises a tubular member enclosing said fluid inlet means.

11. The apparatus of claim 8 wherein said support means for said inner seal ring comprises reinforced support means adapted to fit about said shank means.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,695,669 Dated October 3, 1972

Inventor(s) Faustyn C. Langowski

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 7, line 10 (Claim 8), after "outer" insert --seal--.

Signed and sealed this 3rd day of April 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents