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(54) **POWER SWIVEL INCORPORATING REMOVABLE/REPLACEABLE BEARING CORE**

(76) Inventor: **Clint Musemeche**, Youngsville, LA (US)

Correspondence Address:
Law Office of Jesse D. Lambert, L.L.C.
406 Audubon Blvd.
Lafayette, LA 70503 (US)

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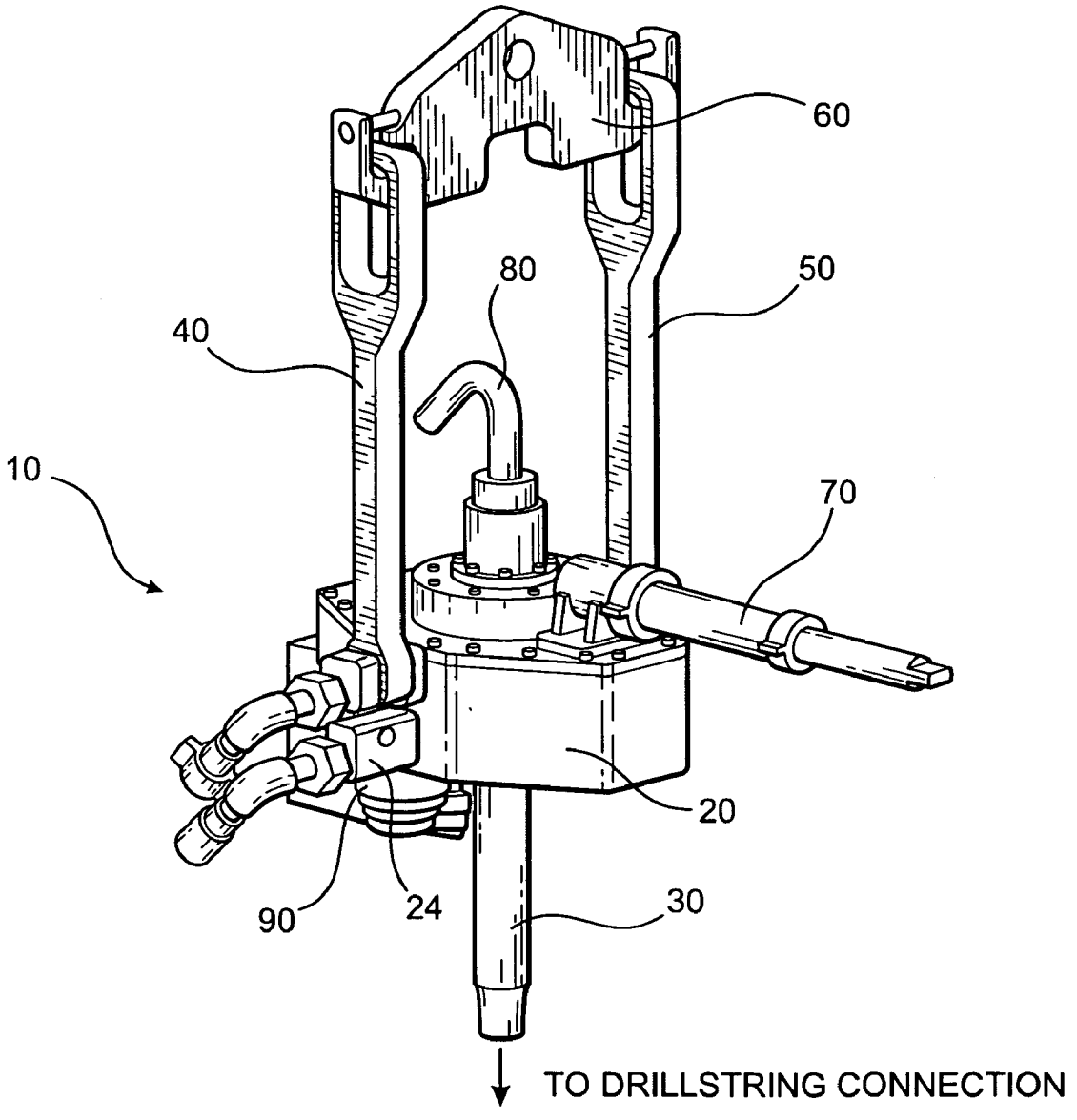
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(57) **ABSTRACT**

A power swivel for rotation of tubulars, particularly in the drilling and servicing of oil and gas wells. The power swivel has a main body with a central cavity, and means for attaching the main body to the hoist mechanism (typically, the traveling block) of a drilling rig. A stem is rotatably disposed in the main body, with a threaded connection on its downward end, for connecting to the tubular string (drillstring). Vertical loads on the stem are transferred to a main thrust bearing which engages the stem. The vertical loads are then transferred to a removable bearing core contained within the main cavity of the main body. The removable bearing core permits relatively inexpensive and expeditious repair of the power swivel.



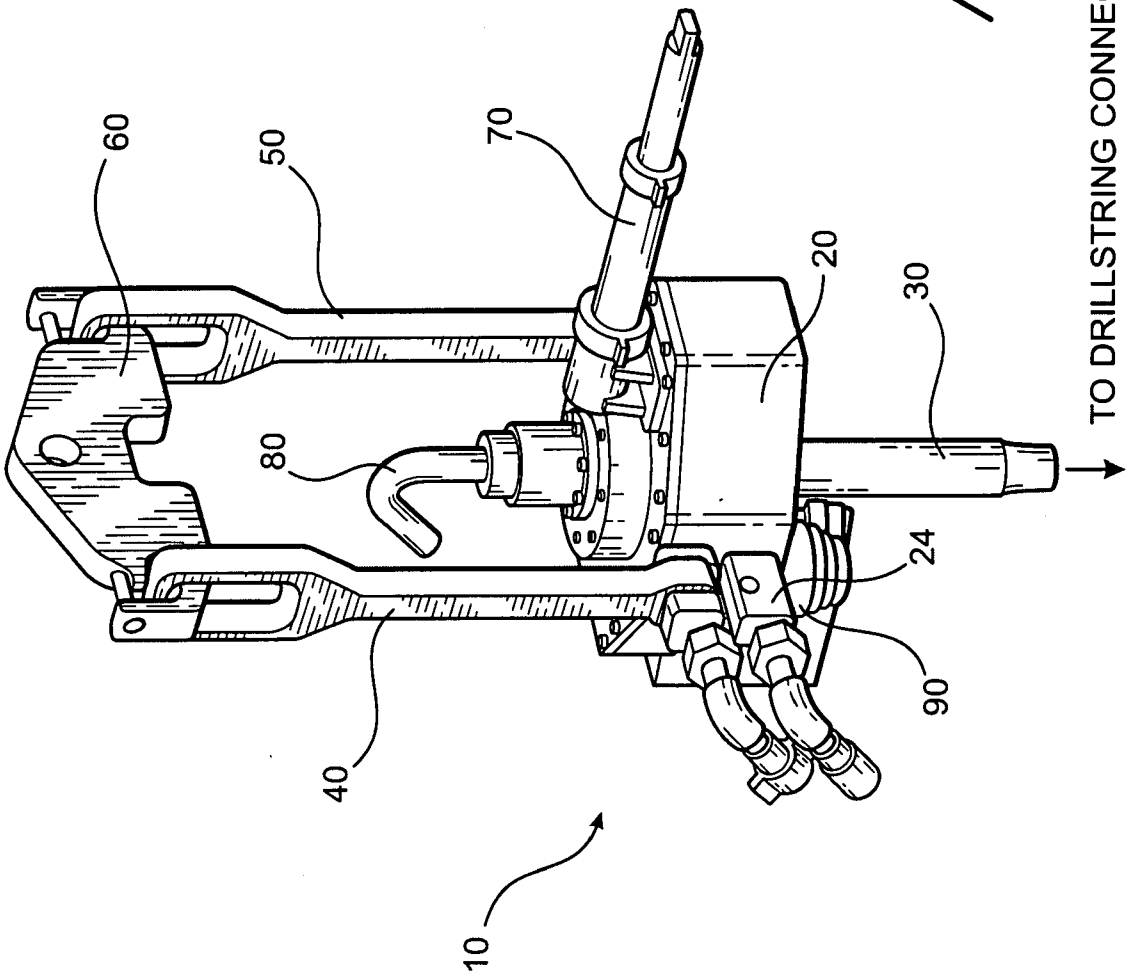


FIG. 1

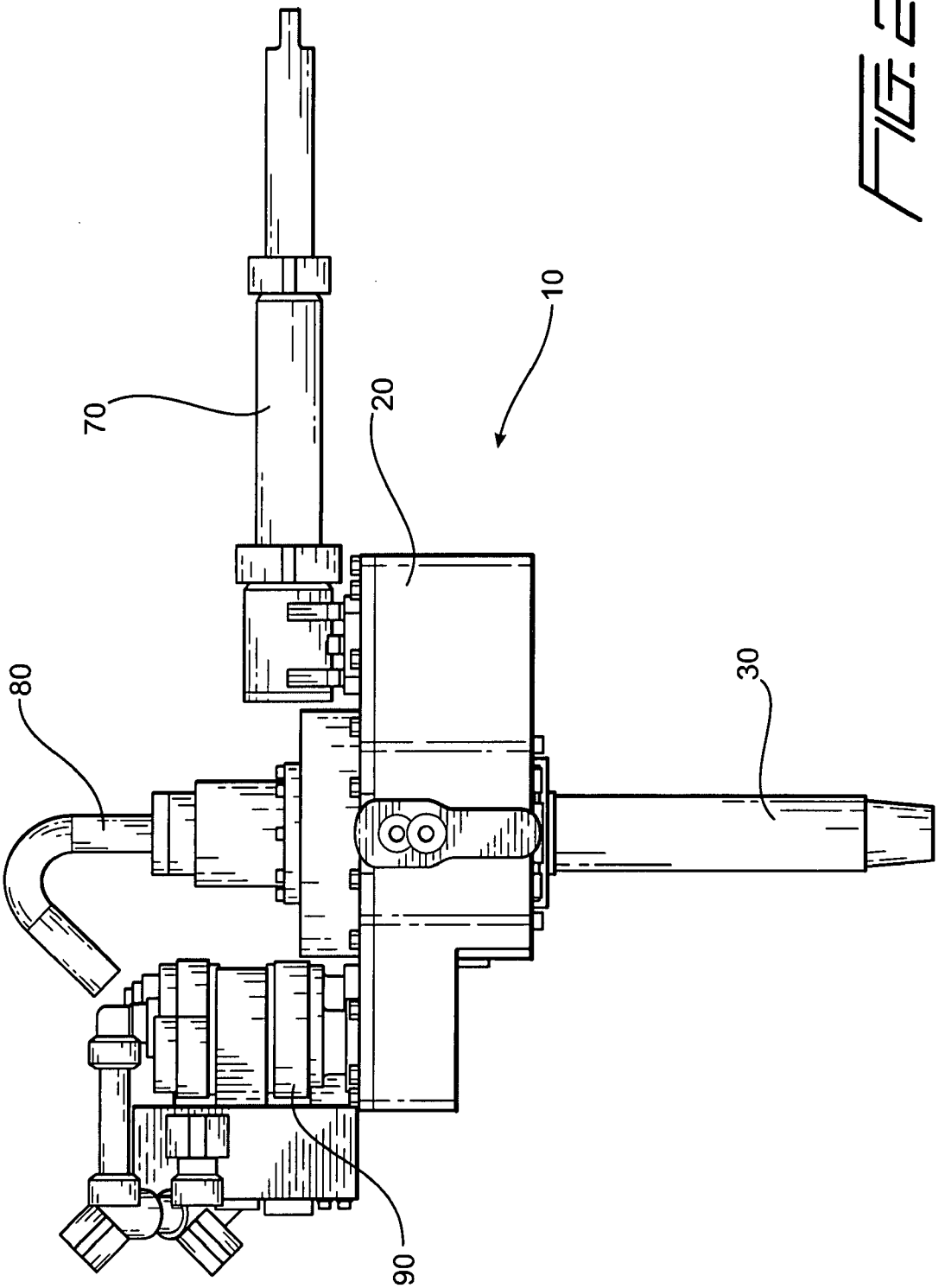


FIG. 2

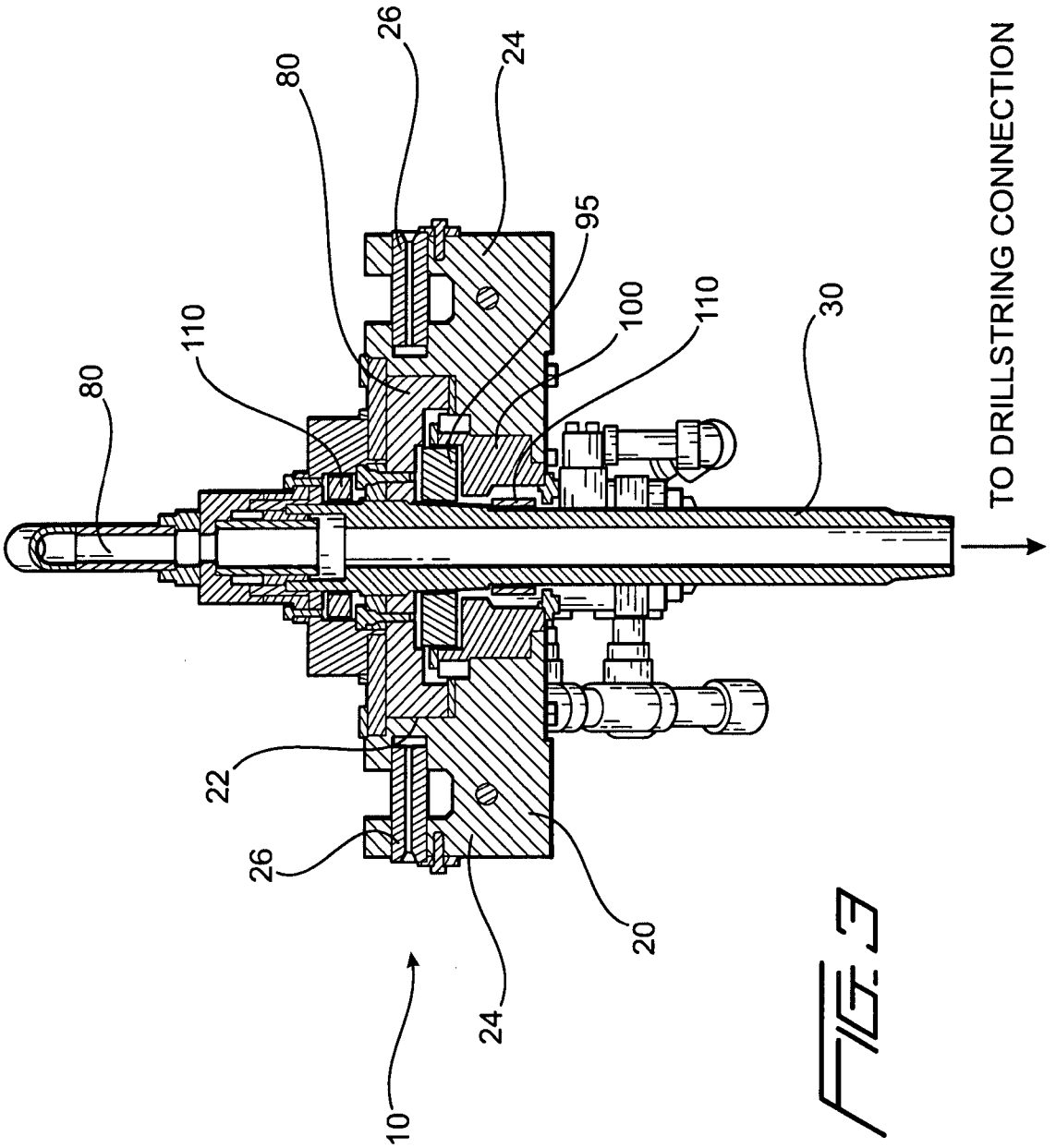

80
26
24
95
100
110
30
TO DRILLSTRING CONNECTION
110
80
22
26
20
24
10

FIG. 3

POWER SWIVEL INCORPORATING REMOVABLE/REPLACEABLE BEARING CORE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] Not applicable.

BACKGROUND

[0002] 1. Field of the Invention

[0003] This invention relates to power equipment used in well drilling and servicing operations. More specifically, this invention relates to equipment used in the handling of threaded tubulars, for example drill pipe and tubing, especially for the rotation of a string of said tubulars for carrying out well drilling and servicing operations.

[0004] 2. Related Art

[0005] Various types of power equipment are used in the handling of threaded tubulars, frequently used in the drilling, completion, and later servicing of oil and gas wells. By one means or another, such tubulars must be rotated in order to make up (screw together) and break out (unscrew) the threaded connections. In addition, in order to carry out drilling operations, the entire tubular string must be rotated, in order to rotate a downhole bit or other tool. Many oil and gas well completion and servicing operations also require rotation of the tubular string.

[0006] Traditionally, the tubular string (which may be referred to herein as the "drillstring," which term is intended to encompass all tubular strings used in drilling, completion, and well servicing operations) was rotated by means of a "rotary" on the rig floor (a rotating mechanism generally centrally located on the floor of the rig), which engaged a drive stem or "kelly" which in turn was threadably engaged to the upper end of the drillstring. For various reasons, other rotary means have been developed to reduce, or in some situations eliminate, the use of a rotary and kelly combination to rotate the drillstring. One such rotary means is the "power swivel."

[0007] In general, as related to this invention, a power swivel is an apparatus for rotating a drillstring within a wellbore (such as an oil or gas well). In its simplest form, a power swivel is an apparatus comprising a fluid-driven (typically hydraulically) motor, which rotates a drive gear. The drive gear is attached to a stem (a relatively short tubular section), which has a threaded connection on its lower end, and a bore through which drilling fluids can be pumped. The drillstring being rotated is threadably engaged on the lower end of the stem. Drilling fluids can then be pumped through the bore of the stem and into the bore of the drillstring.

[0008] Power swivels, in a general sense, are well known in the prior art. U.S. Pat. Nos. 4,074,775 and 4,574,893 disclose exemplary embodiments of power swivels. However, known prior art power swivels share certain structural attributes which require relatively expensive repair as the swivel wears. A key element of power swivels is a "bearing core," which is a part of the power swivel which provides a bearing surface for rotation of the stem, and also transfers the vertical load on the stem to the main body of the power swivel, thereby supporting the weight of the drillstring by the power swivel. The bearing core is contained within the main body of the power swivel; in prior art power swivels, the main body is typically substantially a unitary piece, typically a forging or a casting. The bearing core, like many bearings, will eventually wear and need replacement. In prior art power swivels, the bearing core was, in effect, integral to the main body of the power swivel, in that replacement of the bearing core therefore entailed replacement or re-machining of the power swivel main body, at relatively large expense and time.

[0009] One aspect of novelty of the present power swivel is the removable bearing core, on which the main thrust bearing rotates. With the present invention, if the removable bearing core fails (or simply gets to a wear point at which replacement is desired), it can be removed and replaced (typically in a shop environment), while the remaining components of the power swivel can be re-used. In prior art power swivels, a similar failure meant potential replacement of the main body of the power swivel.

[0010] Still other inventive attributes will be apparent from a reading of the ensuing description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a perspective view of a power swivel of the present invention, having the drive motor mounted from the bottom of the main body, and generally showing the overall layout.

[0012] FIG. **2** is a side view of the power swivel, omitting certain elements for clarity, and showing an embodiment with the drive motor top mounted.

[0013] FIG. **3** is a cross sectional view, showing the various internal components of the power swivel.

DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENT(S)

[0014] With reference to the drawings, some of the presently preferred embodiments of the present invention can now be described. It is to be understood that various changes can be made to the invention, without departing from the scope thereof.

[0015] FIG. **1** is an overall view of the power swivel **10** of the present invention. FIG. **2** is a side view of power swivel **10**, with certain elements omitted for clarity. Power swivel **10** comprises a main body **20** with a main cavity **22** (shown in more detail in FIG. **3**), and a stem **30** rotatably disposed in main cavity **22** of main body **20**. Main body **20** has a means for lifting attached thereto. In the present embodiment, by way of illustration only, said means for lifting comprises (with reference to FIGS. **1-3**), lifting ears **24**, pins **26** inserted through lifting ears **24**, and a pair of bails **40** and **50** connected to said pins **26**. Bails **40** and **50** attach to a lifting bail **60**, which in turn attaches to the hoist mechanism of the drilling rig (not shown, typically a traveling block), or other apparatus used to suspend the power swivel. While in the preferred embodiment the power swivel is typically hoisted by a drilling rig (which term includes other types of rigs, for example completion/workover rigs), the power swivel can be used in conjunction with other hoist apparatus. It is understood that the means for lifting power swivel **10** could comprise other elements; the illustrated embodiment is by way of example only. On the preferred embodiment of power swivel **10**, a torque arm **70** connects power swivel **10** to some structure on the rig, in order to provide resistive force to the torque being imparted on the drill string.

[0016] As can be seen in the figures, power swivel **10** comprises a fluid line **80**, which connects to a pump. Fluids (e.g.,

drilling mud) can be pumped through fluid line **80**, and thence through the bore of stem **30**, and into the drillstring.

[0017] As seen in FIGS. **1-3**, power swivel **10** further comprises a drive motor **90**, typically a hydraulic motor, which drives a ring or drive gear **80** (best seen in FIG. **3**). Drive motor **90** may be mounted on top of power swivel **10**, as in FIG. **2**, or on bottom of power swivel **10**, as in FIG. **1**. As is well known in the art, a drive fluid, for example hydraulic fluid, is pumped to drive motor **90** from a separate power unit. It is to be understood that multiple drive motors could be used, if desired.

[0018] Referring to FIG. **3**, it can be readily seen that the vertical load of the drillstring (threadably attached to the lower end of stem **30**) is carried by stem **30**; that vertical load is transferred to the drive gear **80**, then to the main thrust bearing **95**, then to the removable bearing core **100**. The vertical load is then transferred to main body **20** of power swivel **10**. Vertical loads are then transferred to the means for lifting power swivel **10**, as described above. Power swivel **10** may comprise additional bearings **10** to properly handle other forces imparted on stem **30**.

[0019] Bearing core **100** is designed and configured so as to be readily removable from main body **20**, and replaceable. The particular shape and size of bearing core **100** may be varied to accommodate differing load requirements, and size and geometry of main body **20**. Materials suitable for manufacture of said bearing core include various metals, well known in the art. A key point is that bearing core **100** is separate and removable from the remainder of main body **20**.

[0020] The manner of use of power swivels, in general, is well known in the relevant art. In summary, the power swivel can be used in lieu of the rotary/kelly combination of a conventional rotary drilling rig.

CONCLUSION

[0021] While the preceding description contains many specificities, it is to be understood that same are presented only to describe some of the presently preferred embodiments of the invention, and not by way of limitation. Changes can be made to various aspects of the invention, without departing from the scope thereof. For example, various materials can be used to fabricate the power swivel. Dimensions, torque capability and the like may be varied to best suit the power swivel to its intended use. The hydraulic drive motor(s) may be placed either on top of or on the bottom of the main body of the power swivel; a single hydraulic drive motor or multiple drive motors may be used.

[0022] Therefore, the scope of the invention is to be determined not by the illustrative examples set forth above, but by the appended claims and their legal equivalents.

I claim:

1. A power swivel for rotation of tubulars, comprising:

a) a main body comprising a means for lifting said main body by a hoist mechanism, and comprising a cavity therein;

b) a stem disposed within said cavity of said main body and rotatable therein, said stem having a longitudinal bore and a lower threaded end for connection to a threaded connection on a tubular, said stem engaging a main thrust bearing which supports vertical loads placed on said stem;

c) a drive motor engaged with said stem, to effect powered rotation of said stem; and

b) a bearing core removably disposed in said main cavity of said main body, between said main thrust bearing and said main body, whereby vertical loads on said main thrust bearing are transferred to said bearing core, and thence to said main body.

2. The apparatus of claim **1**, further comprising a torque arm connected to said power swivel.

3. The apparatus of claim **2**, wherein said means for lifting comprises lift ears attached to said main body and bails attached to said lift ears.

4. The apparatus of claim **3**, wherein said drive motor is attached to the bottom of said main body.

5. The apparatus of claim **3**, wherein said drive motor is attached to the top of said main body.

6. The apparatus of claim **1**, wherein said drive motor is attached to the top of said main body.

7. The apparatus of claim **1**, wherein said drive motor is attached to the top of said main body.

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