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BOTTOM HOLE WEIGHT INDICATOR

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This invention relates to a bottom hole weight indicator. In the well industry, it is common to apply weight to a tool by allowing some of the weight of the well string to rest on the tool. The amount of weight applied is measured by a weight indicator connected to the top of the string. However, this indication is not a true representation of the weight actually applied to the tool, since in a deep well the string tends to cock screw within the well and a considerable amount of the weight thereof is supported by frictional engagement with the bore wall. For example, if 10,000 pounds indicated at the top of the well is applied in a well 10,000 feet deep, as much as 6,000 pounds may be supported by frictional engagement with the bore wall, leaving only 4,000 pounds actually applied at the tool.

It is the principal object of this invention to provide a recording weight indicator which may be incorporated in the well string immediately above the tool to be actuated, whereby a permanent record of the actual weight applied to the tool may be obtained.

The preferred form of my invention is described in the following detailed specification, and illustrated by way of example in the accompanying drawings, wherein:

Figs. 1 and 2 show a longitudinal section taken through the upper and lower portions respectively of a tool embodying the principles of my invention.

Fig. 3 is a sectional view of a fragment of the structure shown in Fig. 1 drawn to an enlarged scale.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3.

Referring now to the drawings, wherein similar numerals are used to designate the same elements throughout the various views shown, 10 generally indicates a housing comprising upper and lower sections 11 and 12, respectively. The housing sections 11 and 12 are threadedly connected together in the manner indicated at 13 and the upper end of the section 11 is adapted to be connected to the lower end of a drill string by threads 14. A tubular mandrel 15 is slidably received within the lower housing section 12. Keys 16 mounted in the housing 10 are slidably received in suitable splines in the mandrel to permit relative longitudinal movement while preventing rotational movement between the mandrel and housing in a manner well known in the art. A cap 17 is threaded onto the upper end of the mandrel. The lower end of the cap 17 is adapted to abut the upper end of the lower housing section 12 to limit the upward movement of the housing relative to the mandrel.

The outer surface of the mandrel 15 and the inner wall of the housing section 12 are each stepped outwardly adjacent their lower ends to provide two opposing surfaces 18 and 19, respectively. As can best be seen in Fig. 1, the surfaces 18 and 19 are spaced from each other when the mandrel 15 is in its lowest position relative to the housing section 12 and define an annular chamber 20. A pair of O-ring seals 21 and 22 are mounted in suitable grooves on the mandrel, one above and one below the chamber 20, in sealing engagement with the inner wall of the housing section 12. An annular groove 23 is formed in the inner surface of the mandrel 15 below the chamber 20, and a plurality of downwardly and inwardly inclined drilled passageways 24 connect said groove with the chamber 20. An annular rubber ring 25 is confined between the lower end of the housing section 12 and an upwardly facing external shoulder 26 on the mandrel 15 to prevent the sand and sand from getting between the mandrel and housing.

A connecting member, generally indicated at 27 and having an upstanding stem portion 28 and a lower bell-shaped housing section 29, is threaded into the lower end of the mandrel 15, as shown at 28, with the stem portion 26 extending upwardly therewithin and covering the annular groove 23. A pair of O-ring seals 29 and 30 are mounted in suitable grooves on the stem 26 and sealingly engage the inner wall of the mandrel 15 above and below the annular groove 23. A plurality of drilled passageways 31 in the stem 26 connect the groove 23 with the chamber 22 within the bell-shaped housing 27. A pressure recorder 33 is threaded into and closes the lower portion of the bell-shaped housing 27. The annular chamber 20, passageways 24, the annular groove 23, passageways 31 and the chamber 32 are filled with oil through a plugged orifice 34 connected to the chamber 20, and the plug is then inserted to provide a completely sealed system.

The specific details of the pressure recorder 33 form no part of the instant invention. The recorder is any recorder capable of recording the fluid pressure within the chamber 32. For convenience, the recorder shown is of the type described and claimed in my copending application entitled “Tension Type Pressure Recorder,” filed January 10, 1955, Serial Number 480,707, now Patent No. 2,816,440.

A tubular sub 35 is threaded onto the lower end of the mandrel 15, as indicated at 36, and extends downwardly therefrom encasing the pressure recorder 33 and leaving an annular space 37 therebetween. The lower end of the sub 35 is connected to a second sub 38 at 39. The sub 38 is adapted to be connected at its lower end to a well tool not shown. A spider assembly 40, having fluid passages 41 extending therethrough, is threaded into the upper end of the sub 35 and acts to center the lower end of the pressure recorder 33.

Circulation of the well fluid is provided by the central passage 42 through the mandrel 15 which communicates with a counterbore 43 in the upper end of the stem 26. A plurality of lateral ports 44 connect the counterbore 43 with the annular space between the bell-shaped housing 27 and the inner wall of the sub 35.

In the operation of the device, the members are assembled as shown in Figs. 1 and 2 of the drawing. The lower end of the device is connected to the upper end of a well tool and the upper end of the device is connected to the well string. When weight is applied to the housing 10 moves downwardly relative to the mandrel 15, applying pressure to the oil in chamber 20. The pressure in chamber 20 is communicated through the various passageways described to the fluid in the chamber 32 and actuates the pressure recorder 33. The pressure recorded by the pressure recorder 33 is a direct measurement of the weight actually applied to the tool.

While I have shown and described a specific embodiment of my invention, it is evident that various changes may be made in its construction by those skilled in the art, without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a bottom hole weight indicator, a pair of telescopic members including complementary portions form-
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3. In a bottom hole weight indicator, a tubular housing, means for connecting the upper end of said housing to the lower end of a well string, a mandrel slidably positioned within the said housing for limited longitudinal movement with respect thereto and extending downwardly therefrom, said mandrel and said housing including complementary portions forming a hydraulic pressure chamber adapted to be filled with a fluid and having a volume dependent upon the relative positions of said housing and said mandrel, a pressure recorder secured to said mandrel, said mandrel having a passage therein connecting said pressure recorder and said pressure chamber, and a tubular member for connecting the lower end of said mandrel to a well tool, said mandrel having a passage extending from and adapted to provide fluid communication between said upper housing end and the interior of said tubular member.

4. In a bottom hole weight indicator, a tubular housing, means for connecting the upper end of said housing to the lower end of a well string, a mandrel slidably positioned within the said housing for limited longitudinal movement with respect thereto, said housing having a downwardly facing internal shoulder, said mandrel having an upwardly facing external shoulder opposed to and spaced from said downwardly facing shoulder thereby forming a pressure chamber therebetween, said chamber being filled with a hydraulic fluid, a pressure recorder secured to said mandrel, said mandrel having a passage therein connecting said pressure recorder and said pressure chamber, and a tubular member for connecting the lower end of said mandrel to a well tool, said mandrel having a passage extending from and adapted to provide fluid communication between said upper housing end and the interior of said tubular member.

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