30' "KNOCK-OUT" STABILIZER

By
H. A. (GUS) HICKS

This discussion deals with the packed hole assembly drilling technique to "controlled deviation drilling," how one tool can be used to help accomplish this both economically and easily, and proof of the performance of this tool.

CONTROL DEVIATION

There is no real concern in controlled deviation drilling with angle itself, but only with hole angle change. There are many, many times that conditions dictate a need for controlled non-vertical drilling. The primary one is of course to hit the target area as well as to be able to drill multiple wells from one location, drilling from an inaccessible surface location, relief well control and others.

The reason for restricting hole angle change is very simple. Crooked holes cause problems. These problems occur not only in drilling, but are also carried over into completing and producing a useful well. Some of these problems are damage to drill stems, rods, tubing and casing; stuck pipe, logging tools, and packers; blow outs.

An enormous amount of research has been done in the past 50 years to help the drilling industry learn how, when, where, and why to control rate of hole angle change. Papers, graphs, and charts have been prepared describing maximum permissible dog legs, preventing wall sticking, dog leg severity, knowing exact location of bottom hole, minimum effective hole size, minimum permissible drill collar size, how dip affects angle, formation affects on angle, bottom hole assembly theories, and on and on.

To go along with this research on how, when, where, and why to control rate of hole angle change, hundreds of companies have developed products to answer the industry's question of "What To Use". One of these companies is Oncor Drilling Tools and one of those products is the 30' Knockout Stabilizer. Fig. 1

30' KNOCKOUT STABILIZER

The 30' Knockout Stabilizer is an entirely new concept in downhole rig replaceable stabilization. The complete tool consists of only three basic parts, and is designed to accommodate the gamut of bore-hole and drill collar sizes required by the oil and industrial mining industries.

The tool's three basic parts are as follows:

(1) Stabilizer Body - A single round steel piece 30 feet long with threaded connections on each end of an appropriate diameter to screw into the drill collar string, and having a small bore running the full length of the body's center line for drilling fluid to pass through. Between the threaded connections are machined dove-tail slots located radially and equally spaced vertically around the body, so as to receive the replaceable blade sets.

(2) Replaceable Blade - A machined forging approximately one foot long, 3 inches wide, and 2 inches thick. Full length along one side of the width of the blade is machined dove-tailed shape to match and fit into the female dove-tail slot in the stabilizer

body. On the opposite side is a flat tapered surface machined the full length of the blade, giving a long wedged shape to the blade. The bottom of the blade is perfectly flat and runs parallel and 90° to the dove-tailed side of the blade. The top or gage surface of the blade is approximately radiused for a particular hole size with pressed carbide buttons.

(3) Backup wedge lock - A small solid one piece cast steel part. One side of its width is a machined angle to match the dove-tail slot milled in the body. On the opposite side is a tapered angle to match the tapered angle on the blade. Part of the wedge slides under the last blade to wedge with it and part wedges with the side of the body. Figs. 2 & 3

The "Knockout" stabilizer is assembled in the following manner. Imagine the body of the stabilizer being vertical with one of the milled dove-tailed slots in the body directly in front view. Approaching the body with a replaceable blade in hand, with the thick or wide part of the wedged shaped blade pointed downward, you place the blade into the dove-tail slot in the body, and let it slide downward and bottom out on the slot. With an identical blade turned 180° with the thick or wide part of the wedged shaped blade facing upward, you also place it into the slot into the body and slide it down towards the blade you previously set in the slot. When the second blade physically contacts the first blade, they will engage each other along the matching machined tapered surfaces. As they continue to converge together along this incline plane and expand in width together they become hopelessly locked into the slot in the body. The harder you hammer the wedges together, the tighter they fit into the dove-tail slot, and the mechanical forces holding them in is increased. The two identical blades locked together, and captured in the slot, constitute a virtually solid one foot assembled stabilizing element, and creates the primary lock of the blades in the body. Fig. 3A

The previous procedure is repeated with another set of blades placed the same way in the same slot with the first blade in the second pair physically touching the sets of blades below it, and the second blade in the top blade set being hammered in place forming the second mechanically locked blade set, thus forming another one foot vertically stabilizing blade segment. This makes two identical sets of blades which form a continuous 2 foot vertical stabilizing wing. After securely seating the blades together in the body the wedge lock is slid in under the milled out area of the last blade and also securely seated in place. This acts as a secondary locking wedge force.

If the replaceable blade stabilizer has three or four identical dove-tail slotted wings you continue the blade assembly until the tool is completely dressed. Figs. 4 & 5

When the blades become worn and need replacing, you disassemble the blades from the body by performing the exact reverse of the previously stated assembly process. The only tools needed to dress or undress the stabilizer are a punch and a hammer.

The 30' Knockout Stabilizer enjoys numerous product advantages never before achieved by previous designs. Some of its advantages appear below, and are not listed in order of importance.

(1) The replaceable blades are all completely identical and interchangeable.

(2) The blades themselves, are the locking mechanism that keeps them in place.

(3) When the two blades are in a slot and converge along their incline plane, their combined width expands and fills the mating dove-tail slot, becoming hopelessly locked and trapped.

(4) All frictional hole forces, either up or down, serve only to tighten the wedge shaped blade segments one upon the other.

(5) No annular flow passages need to be machined in the body because a blade set forms a virtually solid wing, not unlike a welded blade stabilizer, that can be stuck out a relatively great distance from the body, thus leaving an enormous annular flow area from wing to wing radially around the body.

(6) Other than a small bore, which every down hole drilling tool has, the body only contains simple milled dove-tailed slot, and the slots do not run full length off the body. The slots only have to be a few inches longer than the stacked blade.

(7) The stabilizer has no threaded keepers, only a simple solid one piece back-up lock.

(8) Blade sets can be stacked one upon the other to create whatever length blade wing required.

(9) Number of blades and orientation can be at users discretion. Fig. 1

(10) Only one connection in a 30' span of stabilization.

The 30' "Knock-Out" stabilizer presently is available in sizes 7 7/8" through 12 1/4". The unique construction of the stabilizer gives you more wall contact and/or more stabilizing action, therefore, giving you the stiffest drill string assembly available in the market today. The 30' "Knock-Out" stabilizer gives you eight square feet of stabilization in hole sizes 7 7/8" through 9 7/8" and twelve square feet of wall contact in the 12 1/4" size.

PERFORMANCE

The information being given has been compiled by Oncor Engineers, Quality Control, and sales personnel, along with bit records for each well involved.

Some performance records for "Knock-Out" #1, Serial Number S151, are as follows.

This "Knock-Out" was run in four wells for a total of 19,585 feet and a total of 681 hours. The RPM's varied in these four wells from a low of 50 to a high of 90. The deviation in these same wells beginning at the top of the 7 7/8" hole were from 1° to 6 1/2° at the top, and at TD the maximum deviation was 1° or less. The 7 7/8" portion of these holes ranges from 4400' to 5300'.

After the completion of the fourth well the stabilizer was checked by our Quality Control people for wear and found to have an average wear of .076 per foot of blades, giving an average wear rate of .004 per 1000' of hole drilled.

It was decided after checking the stabilizer to change the bottom three feet of blades and the top two feet, to bring the stabilizer to full gauge. The middle four feet were still within gauge.

The stabilizer was then ready for the fifth well. The footage of the fifth well was 5,285 feet of 7 7/8" hole, giving a total footage on this stabilizer of 24,870 feet and a total of 843 hours. The average wear rate per foot of blade was .084, which converts to .003 average wear per 1000' of hole for the total 24,870 feet.

Performance records for 7 7/8" "Knock-Out" #2, Serial Number 009500.

This tool was run in three wells for a total footage of 13,038, and a total of 456 1/2 hours. The RPM's ranged from 70 to 100. The deviation at the top of the 7 7/8" hole was at most 2 1/2° and the maximum deviation at TD was 1/2°.

The average wear per foot of blades was .057, resulting in an average wear of .004 per 1000' of hole drilled.

This stabilizer was checked after each well by Oncor Quality Control personnel and judged to be in gauge and in good condition.

Performance records for 7 7/8" 30' "Knock-Out" #3, Serial Number 9506.

This stabilizer is three winged with the slots being offset 120° in each wing and having nine feet of blades per wing.

There were no other changes made in the stabilizer, but the performance records indicate a better wear pattern than the two previous stabilizers.

The footage is 20,423 feet in four wells at a total of 783 1/2 hours.

The RPM's range from 60 to 80 and the deviation ranges from 5 3/4° at the top to a maximum of 3/4° at TD. The 7 7/8" portion of the hole ranges from 4500' to 5600'.

Average wear per foot of blades was .028 at 20,423 feet, which converts to .001 average wear per 1000' of hole. The stabilizer was checked and was in gauge after completing four wells and was waiting for a hole at the writing of this paper.

We have other sizes of these "Knock-Out" stabilizers in other parts of the country doing the same kind of job. However, records and figures were not available in time to be included in this paper.

Records and figures quoted above are available from the Oncor Corporation.

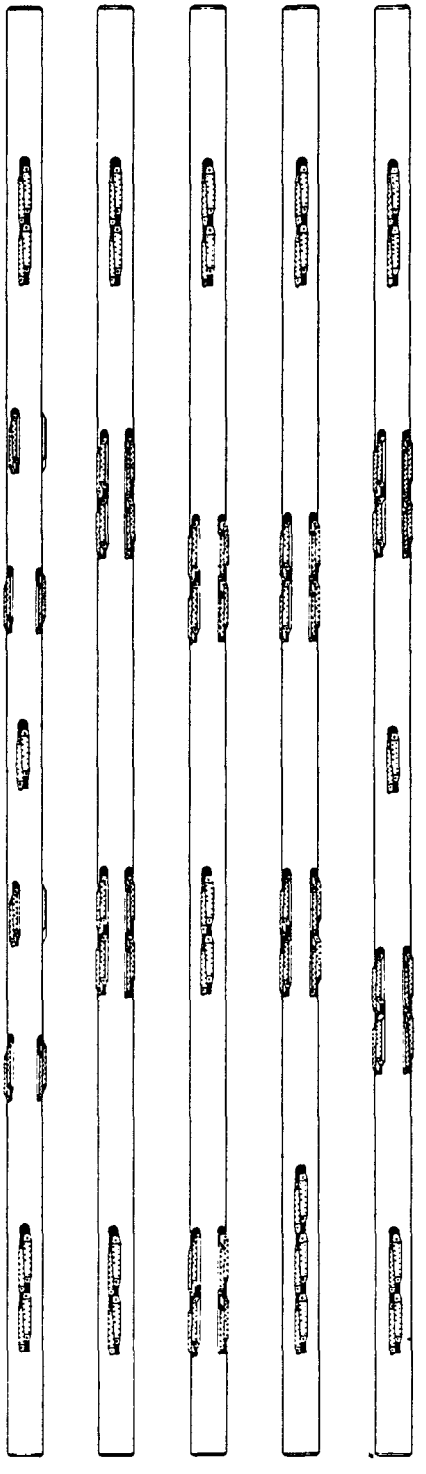

FIGURE 1

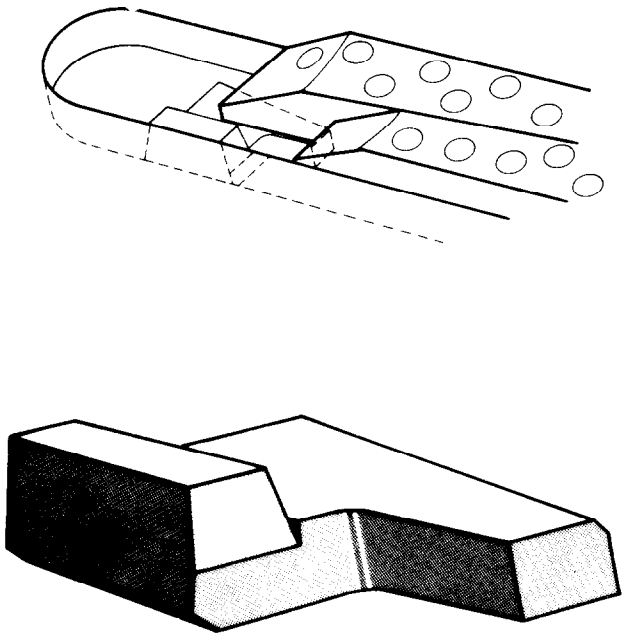

FIGURE 3

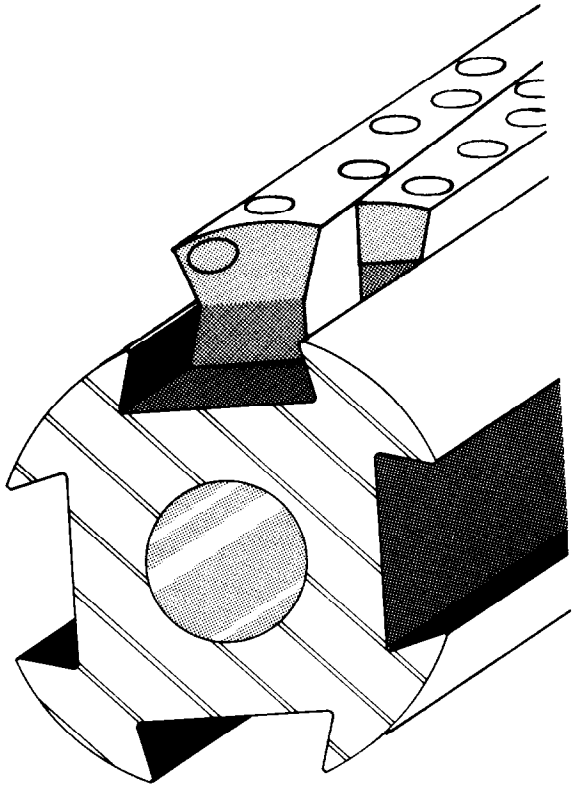

FIGURE 4

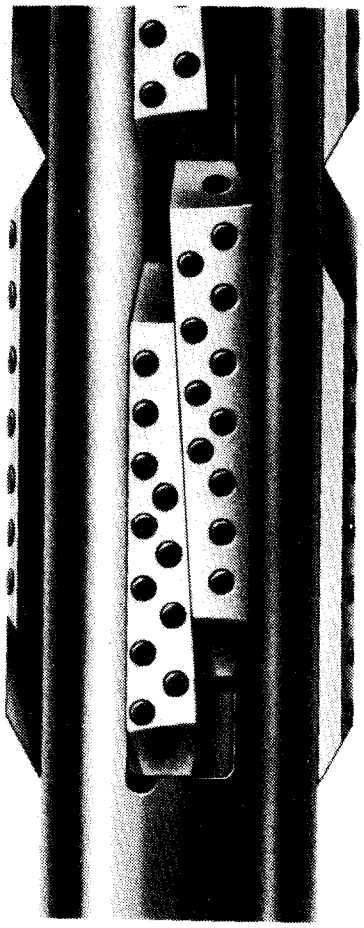

FIGURE 3A

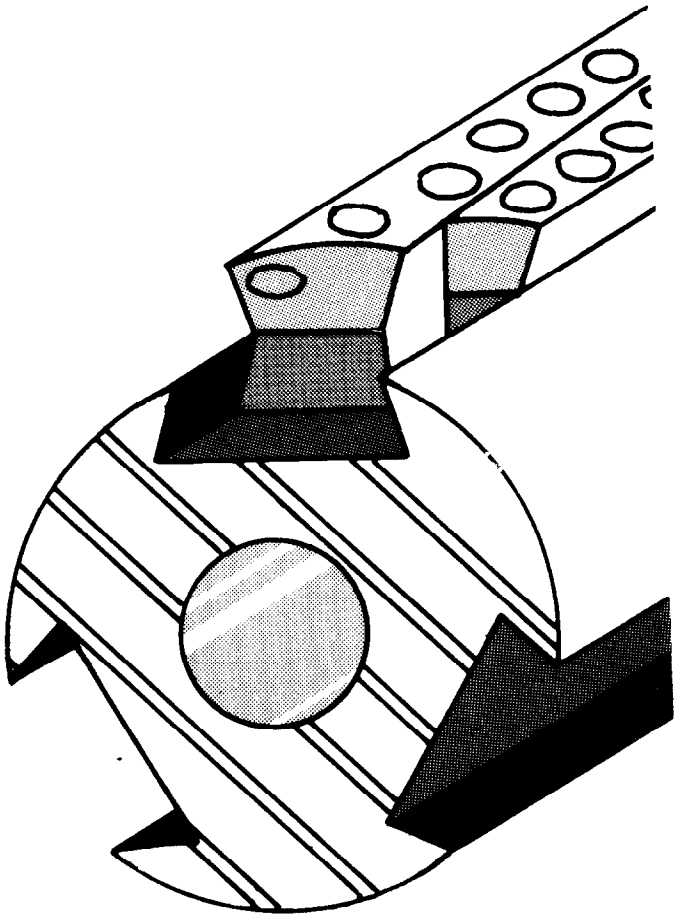

FIGURE 5