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A FIELD TEST ON THE USE OF FIBRE PIPE AS A SUBSTITUTE FOR STEEL IN CEMENTING OIL WELLS*

BY
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A NEW METHOD of casing and cementing oil wells has been successfully tested at a well in the Casey pool, in the W½ NW 2-9n-12w, Johnson Township, Clark County, Illinois. This method, utilizing a special Orangeburg fibre conduit material instead of regular steel casing, was developed by the Illinois State Geological Survey as a war emergency project to save steel and promote petroleum production.

The test was arranged and supervised by the Illinois Geological Survey with the joint cooperation of Dinsmoor Oil Co., owners of the well; Halliburton Oil Well Cementing Co., and Fibre Conduit Co. A number of oil-company engineers were also on hand to witness the demonstration.

DESCRIPTION OF FIELD-TEST PROCEDURE

No difficulties were encountered in the test operation, which was carried through in 12 hours, on a 460-ft. hole, plugged back to 427 ft., and cased from that point to the top with fibre conduit (4⅛-in. i.d.), except for single lengths of steel casing at top and bottom. The shot hole in the 30-ft. saturation zone of the Casey sand was filled with minus 1-in. coal for easy removal after cementing. Crushed limestone and mud were compressed with tools for 3 ft. of plug above the sand top (Fig. 1-A).

The fibre casing, with a bottom length of steel casing, was lowered into the hole on a string of tubing, and supported at the bottom of the tubing string by a special shouldered shoe designed for the job. The shoe was toothed at the bottom to prevent the turning of the casing when the tubing was unscrewed. The anchorage is of importance because the tubing connection with the shoe was made with left-hand threading. This threading design allowed the tubing to be rotated and freed from the shoe after the cement was run, without loosening the shoe assembly, which was also threaded to the end of the casing (Fig. 1-B).

The fibre casing was supported by the shoe to avoid the possibility of parting of casing joints, since the joints were of the beveled friction or "shove" type, with corresponding collars.

DESIGN AND FUNCTION OF THE SHOE

The greatest departure from standard practice is the design and function of the shoe. This unit was made from an extra long steel collar of the same diameter as the fibre casing. Into the top of the shoe was screwed a disk of cast iron, with a threaded hole in the center to receive a similarly threaded nipple of the 2-in. tubing. The first

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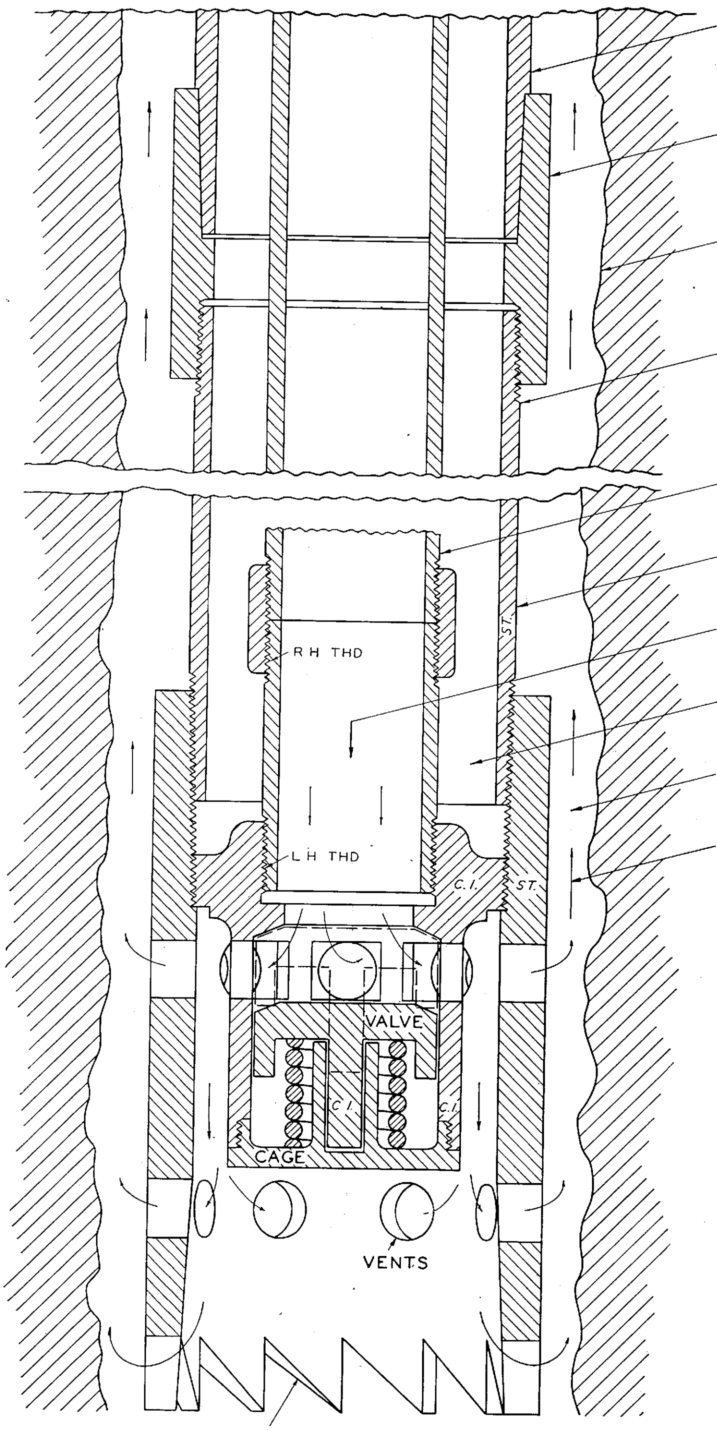

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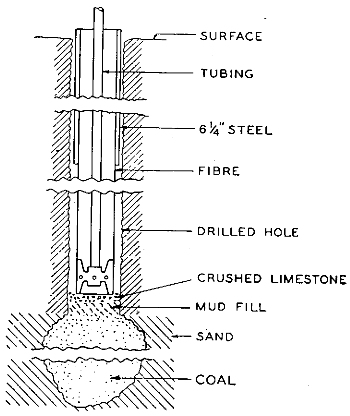
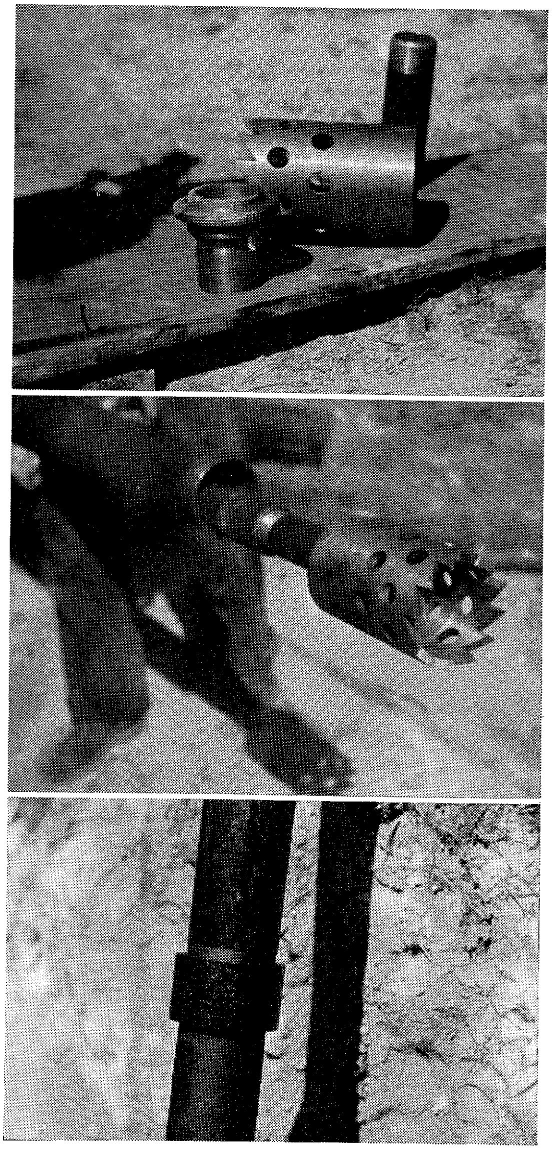


A

FIGS. 1-A and 1-B—Schematic drawing of method used to run fibre casing in well and detailed drawing of special shoe.



ABOVE: Shoe and adapter run on bottom of fibre pipe. MIDDLE: Shoe made up on tubing ready to be slipped over bottom of fibre pipe. BELOW: A joint of the fibre pipe coupled with a fibre switch collar to a joint of steel pipe.

length of tubing was right-hand threaded at its upper end, for a standard collar. A 2-in. valve was inserted on the bottom side of the cast-iron disk. Two rows of holes were drilled around the lower circumference of the shoe below the valve, for flow of cement into the space between casing and drill hole.

After the casing, tubing, and shoe assembly was landed, the Halliburton Co. connected their cementing apparatus to the top of the tubing. Water, mixed with Aquagel, was pumped down the tubing and up around the outside of the fibre casing, until the liquid overflowed at the well head. The annular space between the tubing and fibre pipe was filled with water to a corresponding height to help equalize pressure on the inside and outside of the casing during the cementing operation.

With circulation established, pumping of the water and Aquagel mixture was stopped and the cementing started. The cement was pumped down through the tubing and shoe without difficulty and was made to rise outside the casing until it reached the last joint at the top.

The tubing was then cleaned by pumping water into it, then turned, freeing it from the shoe, and removed from the hole. The valve, being seated, stopped the backflow of cement into the casing. The cast-iron disk and attached valve remained in the shoe and were removed 4 days later by drilling tools during cleanout operations after the cement was set. A visit to the well at this time showed the well to be bailing oil in normal fashion.

PRELIMINARY STUDIES

The Orangeburg fibre conduit material selected for the field test was decided upon after several preliminary studies of other materials. The problem was somewhat simplified by the fact that steel casing is much stronger than is necessary, and that once the cement has been run the cement itself constitutes adequate casing for the hole. The fibre conduit provides the "form" around which the cement can be run and set.

Several types of composition pipe were found to be unsatisfactory because of difficulty of making good joints, or because of expense or excessive weight.

The use of plaster cores was investigated, the theory being that the plaster core could be centered in a hole, after which cement could be run in. The plaster core was to be drilled out after the cement had set. Field tests of this method were not attempted, because it was felt that this would be too radical a departure from oil-field practice, even though the idea may merit future consideration.

Attention was finally focused on the special fibre conduit. This pipe is composed of approximately 75 per cent coal-tar pitch. The remaining 25 per cent is macerated wood fibre and reclaimed pulp paper. It makes a tight friction joint, is light in weight, is strong enough to withstand the strains that are put upon it during cementing operations, is not affected by corrosive water, is inexpensive as compared with the cost of steel casing, is available without priority, and relieves the need for steel, now so vital to the war effort.

Improvements Suggested by the Test

As a result of the testing of this fibre conduit in an actual well installation, certain refinements suggest themselves in regard to future applications of the method described in this paper. It is believed that the cement can be reinforced with better results, and that more positive centering of the fibre conduit can be accomplished. In addition, some improvements in the design of the shoe can no doubt be made.

The author wishes to record his great appreciation of the assistance and cooperation tendered by Henry Lane, of Dinsmoor Oil Co., who was in charge of handling the well at which the test was made, and by the representatives of Halliburton Oil Well Cementing Co. and Fibre Conduit Co., who made the experiment possible in services and materials and who cooperated fully in arranging and carrying out the field trial.

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