United States Patent

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[54] **JET WALL CLEANER**
5 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **166/222,** 166/237, 251/343
[51] **Int. Cl.** **F21b 21/00**
[50] **Field of Search** 166/312, 154, 222, 237; 251/800, 343, 347, 348

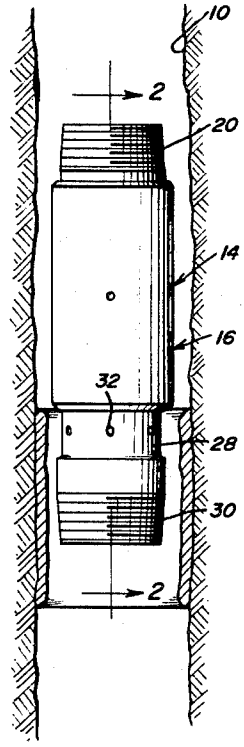
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ABSTRACT: A cleaner for the wall of a well bore including a short full bore tube with a plurality of angulated jet orifices directing a high velocity stream of fluid against the wall of the well bore to effectively clean the wall. A sleeve is slidably mounted on the tube for closing the jet orifices with a locking device securing the sleeve in closed position and a shear pin holding the sleeve in open position until closed by a cement tap plug.



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Fig. 1

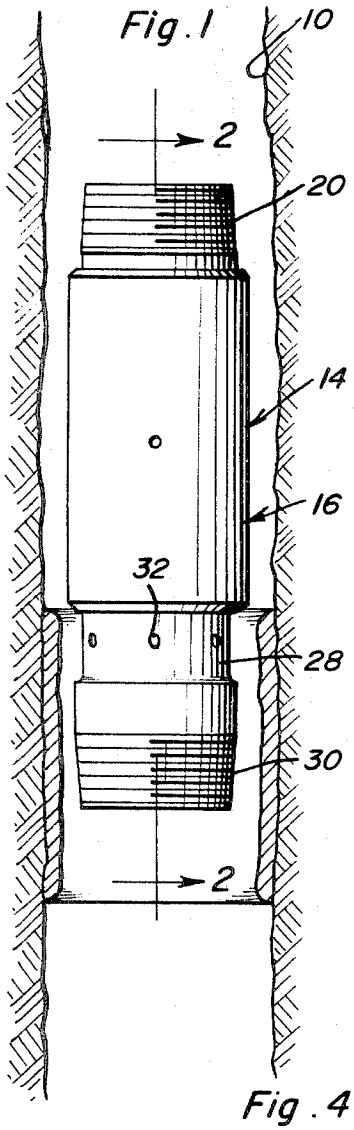


Fig. 6

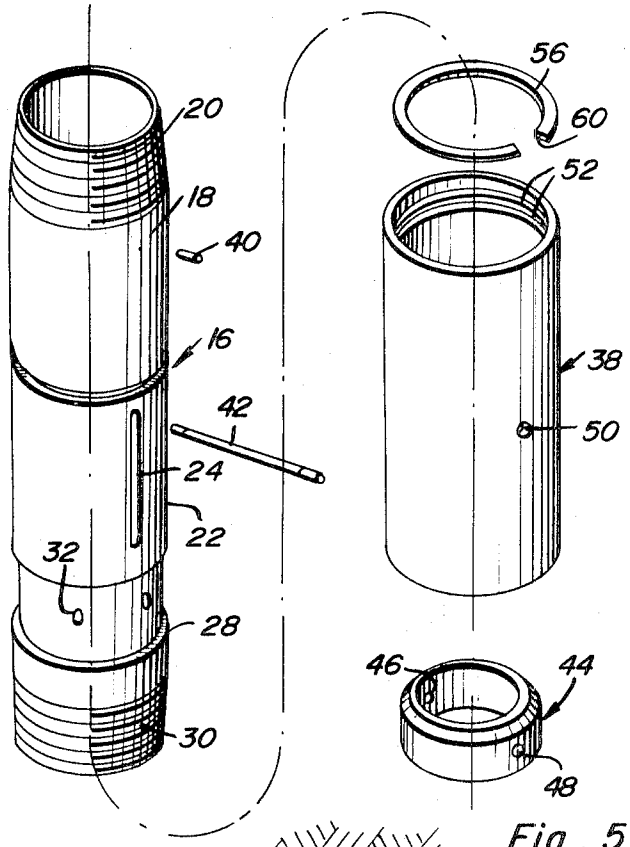


Fig. 5

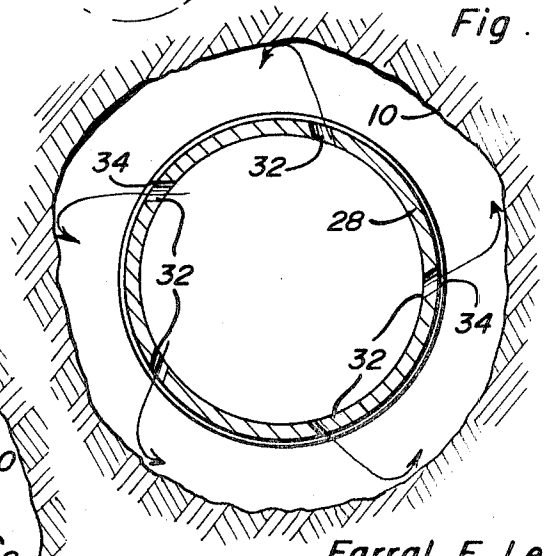
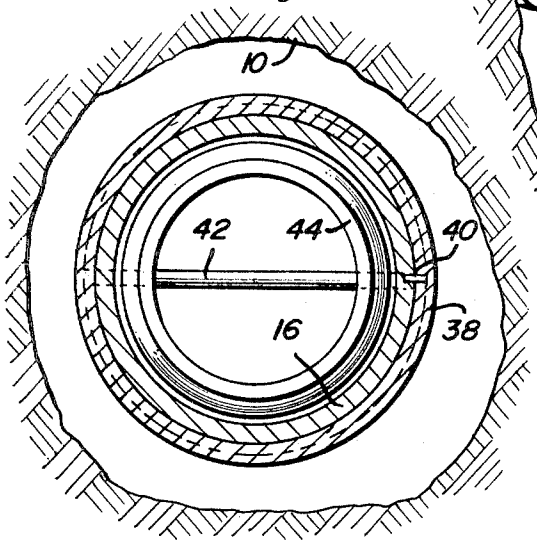


Fig. 4



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Fig. 2

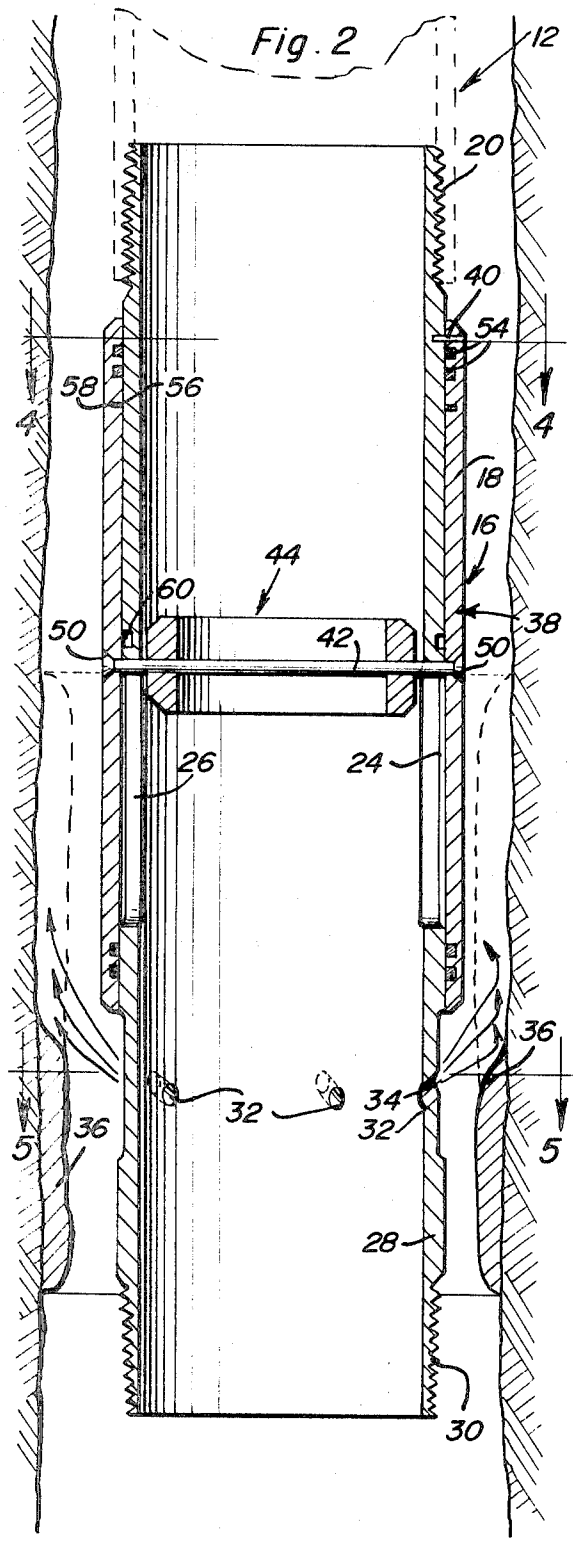
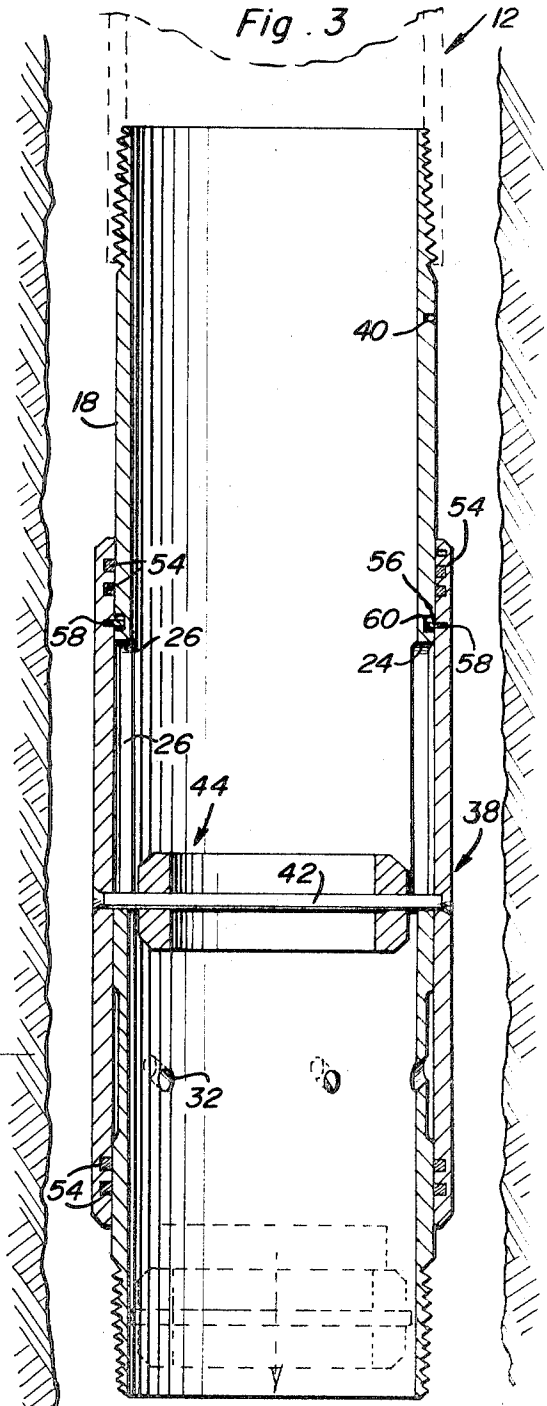


Fig. 3



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JET WALL CLEANER

This invention relates generally to a jet wall cleaner for the purpose of cleaning deposits from a well bore, and comprises an improvement over my prior U.S. Pat. No. 2,771,141, dated Nov. 20 1956.

As set forth in my prior patent, referred to above, the type tools provide a series of spaced fluid jets which use fluid flow to do work usually done by metal or rubber mechanical scratchers. Thus, these tools are designed to assure complete cementation of strings of production casing in the well bore interval adjacent to the location of the tool installed in the string. This tool is designed to eliminate the causes of imperfect cement jobs such as channeling effects and filter cake existence. This is achieved through the use of fluid jet action directed through a series of orifices in the tool. The jet orifices will direct high velocity stream flow of both mud and cement slurry during cementing operations to completely scour the walls of the well bore to remove all existing filter cake. Extremely turbulent flow will be induced and maintained throughout the entire cementing operation, thus eliminating the possibility of cement channeling. By the elimination of both filter cake and channel occurrences, a complete cement bonding effect with both casing and formation can be expected to occur. The extent of the high fluid velocity effects may be lengthened over a greater interval of well bore-through the reciprocation of the tool casing during the cementing operation.

To assure a complete blocking effect above and below an oil producing zone, it is suggested that two of these tools be employed and spaced at predetermined points in the casing string. The selection of correction points may be determined and governed by the location of water-bearing sands above and/or below the zone of interest. By achieving complete cementation above and below the oil producing zone, through the use of two of these tools, the costly necessity of block-squeezing will be eliminated.

Briefly, this invention comprises a tool including a series of spaced fluid jets, which will do the work ordinarily done by metal or rubber scratchers. It is a short compact tool consisting of a full bore tube with five orifices drilled in its lower section at predetermined angles to both vertical and horizontal planes. An orifice closing sleeve valve is fitted externally about the upper section of the tube. This sliding sleeve remains in place and allows fluid flow through the orifices throughout the entire cementing operation until such time as a cement tap plug is pumped downwardly to the bottom of the tool. The plug itself actuates the sleeve so as to close and seal off the jet orifices, the sliding sleeve becoming locked in place by a locking or snapring when in a predetermined position, thereby sealing off all communication of fluid through the jet orifices. The tool mandrel or body has five ¼-inch jet orifices evenly spaced about a circumference at the lower end to direct the stream flow at an angle of 45° upward and 30° clockwise from vertical planes. The sliding sleeve is held in an open position by means of a shear pin preferably designed to shear at 250 p.s.i.g. After the sleeve has been shifted and locked in a closed position, the actuating crossbar therein will be sheared by the cement plug under 550 p.s.i.g. At this time, the cement plug will proceed to the bottom of the string and terminate pumping operations.

It is an object of the present invention to provide an improved jet wall cleaning tool for well bores of the general type set forth in my prior U.S. Pat. No. 2,771,141, dated Nov. 20, 1956.

It is another object of the present invention to provide an improved jet wall-cleaning tool including novel spacing of the jet orifices in the tool body.

It is a further object of the present invention to provide an improved jet wall-cleaning tool including novel externally mounted sleeve means for use therewith.

It is a further object of the present invention to provide means for occluding the jet passages of the tool while the outside diameter of the tool is maintained at the same diameter as a standard coupling in the pipe stand, whereas preexisting tools of this general type have a considerably larger outer diameter.

A still further object of the present invention is to provide jetting means installable in a pipe string and of the same outer diameter as the pipe string thus decreasing the likelihood of the string becoming stuck in the well bore.

A still further object of the present invention is to provide a cleaning tool having the main valving or jet-passage-occluding mechanism located on the outside of the tool, thus improving the functioning of the tool as well as the whole pipe string as the inner diameter of the tool is equal to the inner diameter of the stand of pipes.

It is a final object of the present invention to provide a cleaning tool with sliding sleeve valve means and including novel positive locking snapring stop means for use therewith.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 illustrates a vertical sectional view of a well bore with the jet wall cleaner tool illustrated in vertical elevation therein;

FIG. 2 is an enlarged vertical sectional view taken substantially on the plane of the line 2–2 of FIG. 1;

FIG. 3 is a vertical sectional view similar to that of FIG. 2 illustrating the sleeve valve in a second or closed position;

FIG. 4 is a horizontal sectional view taken substantially on the plane of the line 4–4 of FIG. 2;

FIG. 5 is a horizontal sectional view taken substantially on the plane of the line 5–5 of FIG. 2; and

FIG. 6 is an exploded perspective view illustrating the various parts of the tool comprising the present invention.

Referring now more particularly to the drawings, reference numeral 10 denotes a well bore which has supported therein a casing string or stand 12 as well as the jet wall cleaner tool 14 comprising the present invention.

The tool 14 comprises a tubular body or mandrel 16 having an upper section 18 which is threaded as indicated by reference numeral 20 in order to be fitted into the casing stand 12, an intermediate enlarged section 22 having a pair of diametrically opposed vertically extending slots 24 and 26 therein, and a lower section 28 threaded as denoted by reference numeral 30 so as to be received in the casing stand 12.

The body 16 has a plurality of jet ports or orifices 32 spaced circumferentially thereabout in the body section denoted by reference numeral 28, the orifices being equally spaced and inclined at an angle of approximately 30°to a vertical plane taken through the center of the body, and at an angle of approximately 45°upwardly to a plane taken perpendicularly to the center axis of the body. Thus, by referring to FIGS. 2 and 5 in particular, it will be observed that there are five such orifices spaced about the body, the orifices being equally spaced from the end of the tool, and being so slanted upwardly and laterally so as to cause a swirling effect about the tool when the fluid is pumped through the orifices. Thus, the high-velocity stream flow of mud and cement slurry, which is directed outwardly of the tool through the orifices during the cementing operation will completely scour the walls of the well bore to remove all existing filter cake deposit formed thereon. As seen in these figures, each jet orifice opens outwardly of the body of the tool as denoted by reference numeral 34 and, as the tool is moved through the well bore 10, the deposits 36 will be gradually washed away.

A sleeve valve generally denoted by reference numeral 38, comprising a hollow elongate tubular member of substantially the same inner diameter as the outer diameter of the body 16 is mounted on the body 16. The sleeve valve 38 is, of course, slidable along the body, and thus a shear pin 40 is provided to

retain the valve **38** in the position illustrated in FIG. **2**, the pin **40** connecting the valve to the body. A crosspin **42** extends across the sleeve valve **38**, and through the slots **24** and **26**, the pin **42** having a stop abutment collar **44** mounted thereon. Of course, as will be readily apparent by viewing FIG. **6**, the collar **44** is provided with openings **46** and **48** therein through which the pin **42** extends, the pin **42** then being fixedly mounted in the openings **50** in the sleeve valve **38**. The sleeve valve **38** further is provided with a plurality of peripherally extending internal grooves **52** in which O-rings **54** are mounted in order to provide a seal between the sleeve valve and the body.

Referring once again to FIGS. **2**, **3** and **6**, it will be observed that a snapring **56** is mounted in an internal circumferentially extending groove **58** adjacent the upper end of the sleeve valve **38**, the snapring **56** being preferably constructed of a resiliently flexible material and being split as indicated at **60** whereby it will have a tendency to move inwardly against the wall **16**. A groove **60** extends peripherally about the body **16** immediately above the slots **24** and **26**. Thus, it will be observed from viewing FIGS. **2** and **3** in particular that the ring **56** will snap into the groove **60** when the sleeve **38** is moved downwardly with the crosspin **42** moving from the upper end of the slots **24** and **26** to the lower end thereof. This snapring **56** will retain the sleeve **38** in the position illustrated in FIG. **3** as it will then reside partially in groove **58** and partially in groove **60**.

In operation of the tool **14**, the scouring fluid is pumped downwardly into the tool when the sleeve valve **38** is in its uppermost position, as illustrated in FIG. **2**, the sleeve valve being retained in this position by the shear pin **40**. The fluid will flow outwardly through the orifices **32** to clean the bore wall. When it is desired to occlude the orifices **32**, a cement tap plug is dropped downwardly through the casing stand until it abuts the stop collar **44**, the plug actuating the sleeve valve by exerting a force of approximately 250 p.s.i.g. against the shear pin **40** which is designed to shear under this pressure. At this time, the sleeve will move downwardly to the position illustrated in FIG. **3**, the snapring **56** locking the sleeve against vertical movement, and the crosspin **42** reaching the bottom of the slots **24** and **26**. At this time, fluid may be pumped downwardly through the tool, the orifices **32** being sealed off by the sleeve valve **38** with the O-rings **54** operating to ensure a fluid seal. When it is desired to pump the cement tap plug downwardly through the casing stand past the stop collar **44**, additional fluid is pumped therein until a pressure of approximately 550 p.s.i.g. is exerted against the cement plug, this being the shear strength of the crosspin **42**. Thus, under this pressure, the pin **42** will shear and the pin and collar will be carried to the bottom of the casing stand, thereby terminating the pumping operation. Of course, it will be appreciated that shear pins of various strengths may be utilized in the tool at the discretion of the operator.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What I claim as new is as follows:

1. In a jet wall cleaner for jetting a high velocity fluid against the wall of a well bore for cleaning deposits therefrom and including a tubular section having oppositely spaced vertical slots therein, the improvement comprising, sleeve valve means slidably mounted on the exterior of said tubular section, jet orifice means in the wall of said tubular section, means for retaining said sleeve valve means in a first position wherein said jet orifice means are open, a crosspin in said sleeve valve means extending through said slots, and means for moving said sleeve valve means to a second position in response to pressure on said crosspin wherein said jet orifice means are closed, and lock means retaining said sleeve valve means in said second position, said lock means being substantially ringlike in configuration thereby providing an effective lock about a substantial portion of the periphery of the tubular section.

2. The combination of claim **1** wherein said jet orifice means includes a plurality of circumferentially spaced orifices in said tubular member, said orifices being inclined at an angle to a plane perpendicular to the axis of said tubular section and to a plane including the axis of said tubular section whereby fluid flowing from said orifices will flow in a swirling pattern in said well bore.

3. In a jet wall cleaner for jetting a high velocity fluid against the wall of a well bore cleaning deposits therefrom and including a tubular section having oppositely spaced vertical slots therein, the improvement comprising, sleeve valve means slidably mounted on the exterior of said tubular section, jet orifice means in the wall of said tubular section, means for retaining said sleeve valve means in a first position wherein said jet orifice means are open, a crosspin in said sleeve valve means extending through said slots, and means for moving said sleeve valve means to a second position in response to pressure on said crosspin wherein said jet orifice means are closed, and means in said sleeve valve means for locking said sleeve valve means in said second position, said sleeve valve means including a circumferentially extending internal groove substantially adjacent the upper end thereof, said locking means comprising a locking snapring seated in said internal groove, and a peripherally extending groove in said tubular section, said locking snapring engaged in said peripherally extending groove when said sleeve valve means is in said second position.

4. The combination of claim **3** wherein said peripherally extending groove is disposed above the upper ends of said slots.

5. The combination of claim **3** wherein said crosspin includes a collar mounted thereon interiorly of the tubular section, said jet orifices being disposed below the lower ends of said slots.