March 21, 1933. M. J. LEWIS 1,902,174

WELL BORE STRAIGHTENING TOOL

Filed Jan. 13, 1932

Fig. 1.

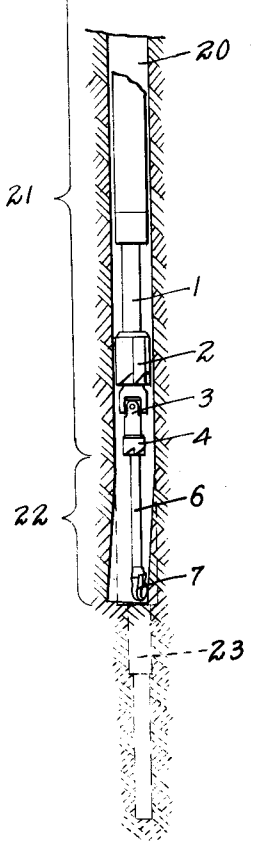


Fig. 2.

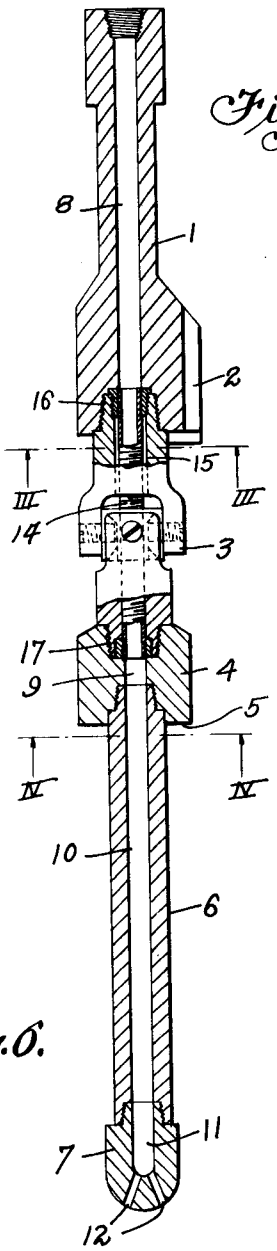
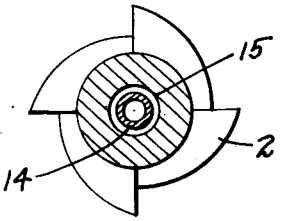


Fig. 3.



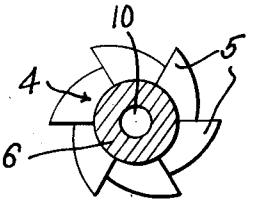


Fig. 4.

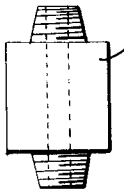


Fig. 6.

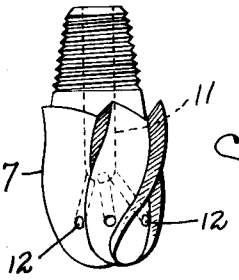


Fig. 5.

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UNITED STATES PATENT OFFICE

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WELL BORE STRAIGHTENING TOOL

Application filed January 13, 1932. Serial No. 586,293.

This invention relates to a well bore straightening tool which is particularly applicable for bringing the bore of an oil well, which has deviated from its true course, back into correct vertical alignment therewith.

It is the principal object of this invention to provide a tool which may be used to straighten a well bore which has deviated from its true course.

A further object of this invention is to provide a well bore straightening tool with a universal mounting for the tool portion, whereby said portion will remain vertical even though the well bore inclines from the vertical.

A further object of the invention is to provide a flexible duct means through the universal joint for conducting the drilling fluid therethrough.

A further object of the invention is to provide a tool which will drill a pilot hole in vertical alignment with the well bore, and which may then be used to drill out the pilot hole to the diameter of the well bore.

A further object of this invention is to provide a well bore straightening tool with reaming means which will act during the drilling of the pilot hole to partially remove the inclined area of the bore.

Other objects and advantages of this invention will be apparent as the nature of the same is more fully understood from the following description and accompanying drawing wherein is set forth what is now considered to be a preferred embodiment. It should be understood, however, that this particular embodiment of the invention is chosen principally for the purpose of exemplification and that variations therefrom in minor details of construction or arrangement of parts may accordingly be effected and yet remain within the spirit and scope of the invention as the same is set forth in the appended claims.

In the drawing:

Figure 1 illustrates in full lines the invention ready to start in the operation of straightening a well bore, while in broken lines is illustrated the pilot hole drilled by the tool;

Figure 2 is an enlarged sectional view of the invention;

Figure 3 is a sectional view taken substantially along the line 3—3 of Figure 2;

Figure 4 is a sectional view taken substantially along the line 4—4 of Figure 2;

Figure 5 is an enlarged plan view of the pilot hole drilling bit; and

Figure 6 illustrates the double pin sub.

The preferred embodiment of the invention, as illustrated most clearly in Figure 2, includes a reamer 1 adapted to be attached to the usual drill rod or pipe and is provided with a cutting or reaming portion 2 of the full size of the hole. One end of a universal joint 3 is securely screw threaded into the lower end of the reamer 1, while the opposite end thereof is likewise screw threaded into the small reamer 4. As will be noted from Figure 4, the small reamer is provided with cutting teeth 5 and, like the large reamer, is threaded to receive the drill collar 6. A bit 7 is suitably secured to the lower end of the drill collar.

It is important to provide a drilling fluid circulating passage through the tool. As illustrated most clearly in Figure 2, a passage 8 is provided through the large reamer 1, a passage 9 through the small reamer 4, and a passage 10 through the drill collar (while the bit 7 is provided with the fluid passage 11 into which the discharge ports 12 connect). It is essential that a drilling fluid passage be provided through the universal joint in order to connect the fluid passages 8 and 9 in the large and small reamers, respectively, and for this purpose any suitable form of flexible hose or pipe 14 may be provided through the bore 15 thereof. The flexible hose 14 may be secured and sealed to the opposite ends of the universal joint bore 15 by means of suitable screw flanges 16 and 17.

With the flexible hose mounted in the universal joint, as described, the joint is free to swing, as the hose, being flexible, easily bends to accommodate the swinging thereof and by this arrangement a pressure tight fluid passage is provided through the universal joint to connect the fluid passages 8 and 9 of the other portions of the tool.

The operation of the tool in straightening a well bore will now be described. In Figure 1 a well bore 20 has substantially followed a true vertical course for the distance indicated by 21, while the section 22 has deviated or inclined therefrom. As soon as the operator becomes aware that the well bore has deviated from its true vertical course, by means of an acid bottle, inclinometer, or other appropriate means, the drill string is removed therefrom and a squaring-off tool is mounted upon the drill pipe and the bottom of the bore squared off in the usual manner, whereupon the drill string is again removed and the straightening tool of this invention substituted therefor. The straightening tool is run in to the position, as shown in Figure 1. Due to the universal joint 3, the reamer 4, drill collar 6 and bit 7 will hang in a vertical position. By shortening the drill collar 6, the angle of swing may be increased, should the bore be so inclined that bit 7 will come against the side of the hole before it reaches the vertical.

The drilling fluid is circulated to wash out any heavy mud, sand or cuttings that may be in the bottom of the well bore 20. When the bore is thoroughly washed out the circulation is shut off. Next the tool is set down on the bottom of the bore, before being rotated, to insure the tool starting a vertical bore. The bit 7 is round nosed to insure that the bit will start drilling where it is set down, and also, by making the nose of the bit rounded, it will not have a tendency to "walk" around the bottom of the bore.

The bit 7 is first rotated slowly, weighted lightly until the bit is well seated, then the circulation is started and drilling carried ahead in the usual manner.

By continuing the drilling operation of the tool, the pilot hole 23 will be bored. As there is very little clearance in the pilot hole for the drill collar 6 made by bit 7, the bit can deviate but slightly from the vertical and then in the opposite direction from the direction taken by the bore when it started to deviate.

By increasing this clearance, the angle of inclination of the pilot bore can be increased and the pilot hole made by bit 7 can be brought back in line with the straight bore.

As bit 7 penetrates the formation, the large and small reamers are forced against the side of the bore and cut it out to full size, as illustrated in broken lines in Figure 1. When sufficient hole has been made to place the reamer 1 down to where bit 7 started, the tool is withdrawn.

Next the universal joint 3 is removed and the double pin sub 25 (note Figure 6) is put in place thereof, making the tool rigid. The bit 7 is also removed and a diamond pointed bit with rounded shoulders of the usual type (and therefore not shown) is put on in place thereof. The diamond bit will follow the pilot hole 23, and as now the reamers are rigid they will cut off all sharp angles in the bore, making the hole straight. The pilot hole left below the reamers can then be reamed out with the ordinary drilling bits and drilling continued until the bore again requires straightening.

While I have illustrated the preferred form of my invention, it is to be understood that the foregoing description is for illustrative purposes only, and I do not desire to be limited by any of the details shown, except as defined in the appended claims.

I claim:—

1. A well bore straightening tool including a first reamer means, a second reamer means, a universal joint for interconnecting said reamers, and a round nosed drilling bit carried by said second reamer means.

2. A well bore straightening tool including a first reamer means having a circulating fluid passage formed therethrough, a second reamer means also having a circulating fluid passage formed therethrough, a universal joint means interconnecting said reamers, a flexible duct means interconnecting said circulating fluid passages, and a round nosed drilling bit carried by said second reamer means and having a circulating fluid passage in communication with the aforesaid passages.

3. A well bore straightening tool including a first reamer means, a circulating fluid passage formed therethrough, a second reamer means, a circulating fluid passage formed therethrough, a universal joint means interconnecting said reamers, a flexible duct means extending through said universal joint, means for interconnecting said passages, and a round nosed drilling bit operatively carried by said second reamer means and having a circulating fluid passage in communication with the aforesaid passages.

4. A well bore straightening tool including a first reamer means, a second reamer means, a universal joint means interconnecting said reamers, a drill collar secured at one end to said second reamer means, and a drilling bit secured to the other end thereof.

5. A well bore straightening tool including a first reamer means having a circulating fluid passage formed therethrough, a second reamer means also having a circulating fluid passage formed therethrough, a universal joint means interconnecting said reamers, a flexible fluid duct means interconnecting said circulating fluid passages, a drill collar secured at one end to said second reamer means and having a fluid passage therethrough, and a drilling bit secured to the other end thereof and having a circulating fluid passage in communication with the aforesaid passages.

6. A well bore straightening tool includ-

ing a first reamer means, a second reamer means, a universal joint interconnecting said reamers, and a drilling bit carried by said second reamer means.

7. A well bore straightening tool including a first reamer means having a circulating fluid passage formed therethrough, a second reamer means also having a circulating fluid passage formed therethrough, a universal joint means interconnecting said reamers, a flexible duct means interconnecting said circulating fluid passages, and a drilling bit carried by said second reamer means and having a circulating fluid passage in communication with the aforesaid passages.

8. A well bore straightening tool including a reamer, a drilling bit, and a universal joint operatively connecting said reamer and bit.

9. A well bore straightening tool including a first reamer means having a circulating fluid passage formed therethrough, a drilling bit having a circulating fluid passage formed therethrough, a universal joint operatively connecting said reamer and bit, and a flexible duct means interconnecting said reamer and bit circulating fluid passages.

Signed at Chauk, Burma, India, this 11th day of November, 1931.

MILES J. LEWIS.