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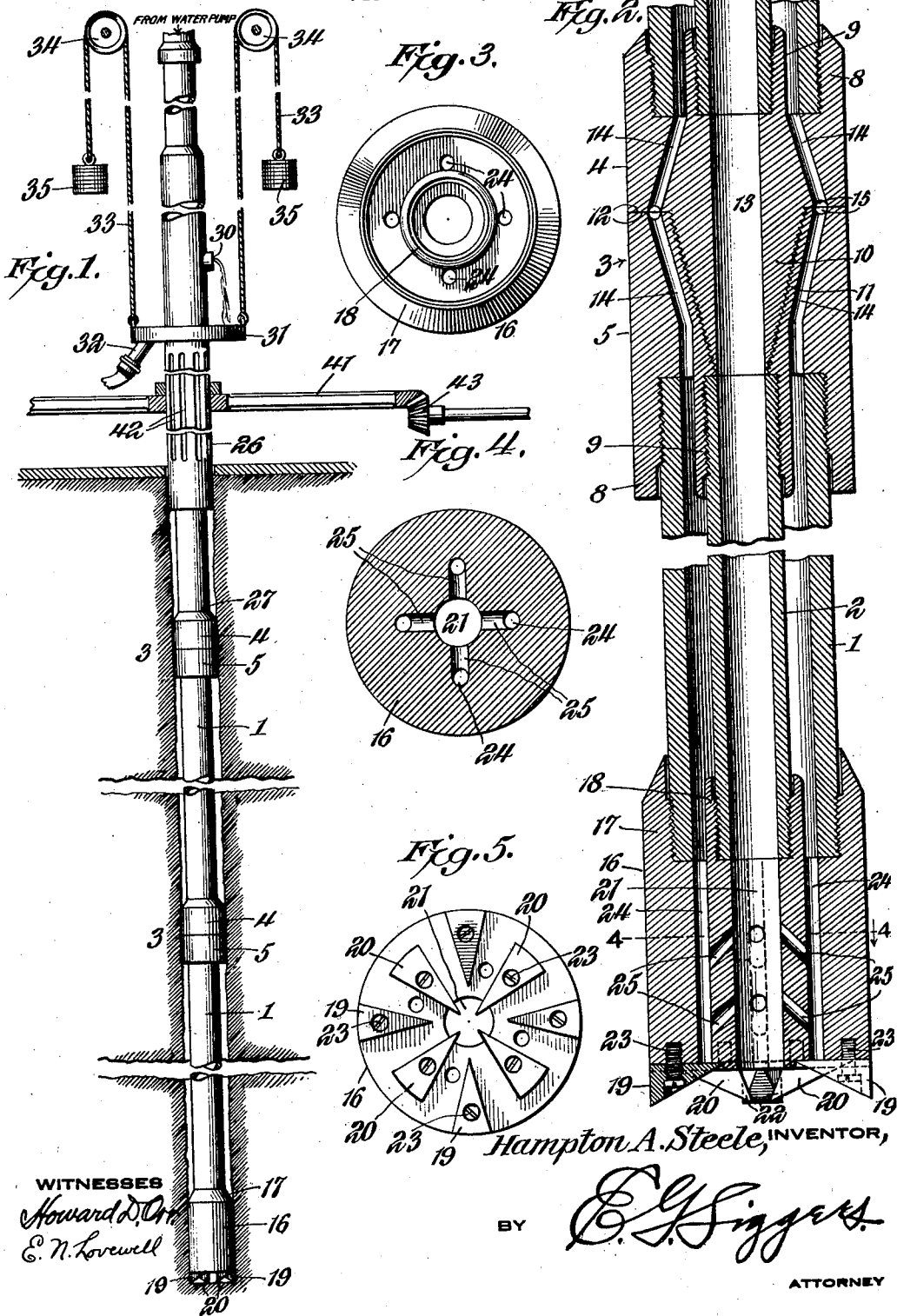
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H. A. STEELE

METHOD AND APPARATUS FOR DRILLING WELLS

Filed Feb. 5, 1924

2 Sheets-Sheet 1



WITNESSES

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July 28, 1925.

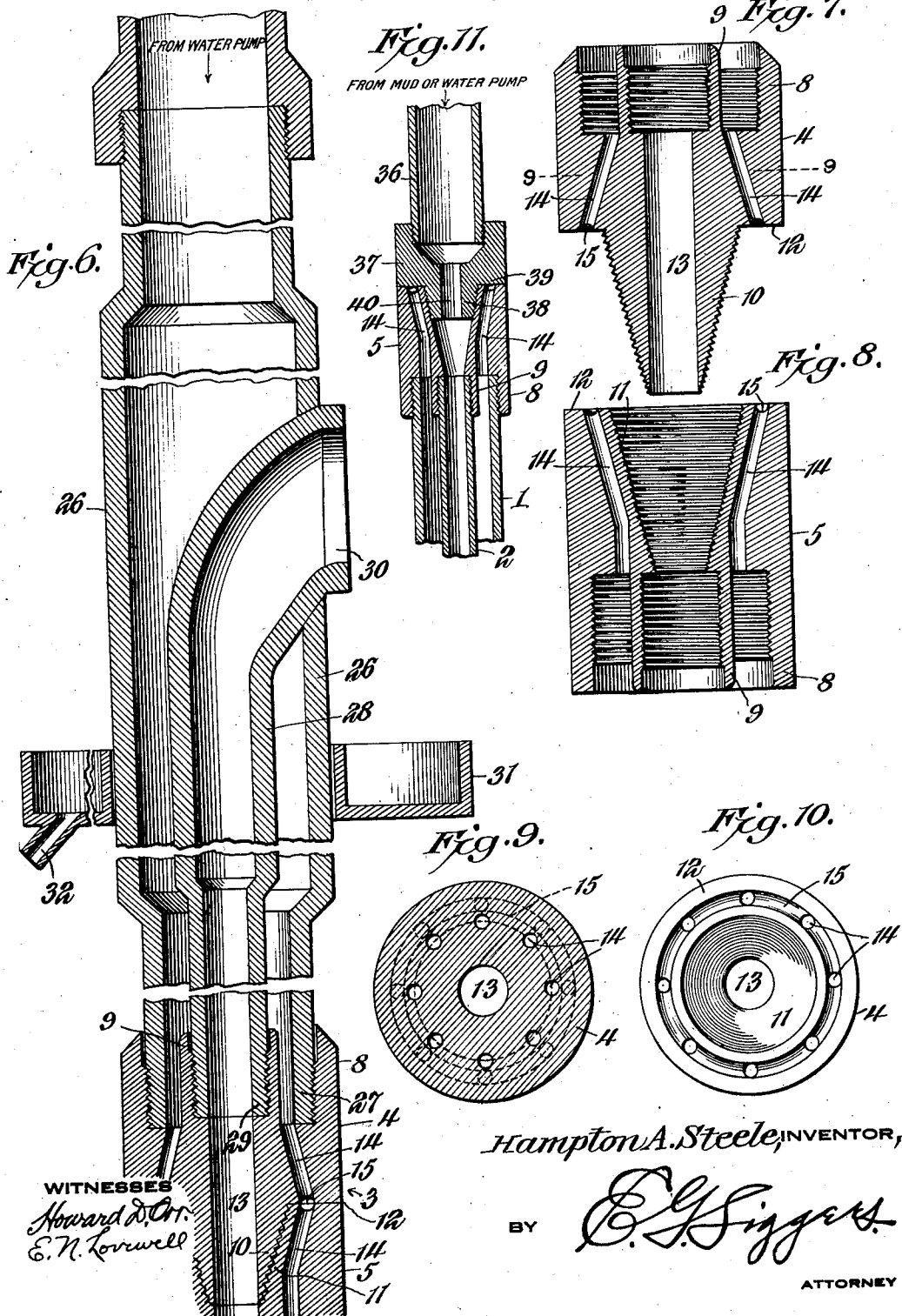
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UNITED STATES PATENT OFFICE.

HAMPTON A. STEELE, OF LAWTON, OKLAHOMA.

METHOD AND APPARATUS FOR DRILLING WELLS.

Application filed February 5, 1924. Serial No. 690,806.

To all whom it may concern:

Be it known that I, HAMPTON A. STEELE, a citizen of the United States, residing at Lawton, in the county of Comanche and State of Oklahoma, have invented a new and useful Method and Apparatus for Drilling Wells, of which the following is a specification.

This invention relates to the drilling of wells, with particular reference to the location and determination of oil or gas bearing sands or the like. The present invention will generally be used in connection with the devices disclosed in my companion applications, Serial Nos. 690,805 and 690,807, filed of even date herewith.

In carrying on drilling operations, particularly when prospecting in fields which have not been proven, it is desirable to obtain an accurate record of the different strata, not only to avoid missing any productive sands, but also for purposes of comparison to determine their probable trend and extent. This has usually been accomplished by what is known as core drilling, in which a core barrel is used, having at its lower end a cutting tool with an annular series of teeth, and the entire string of pipe is withdrawn from time to time in order to obtain the core.

The general object of the present invention is to provide a method and apparatus for drilling, which constitutes an improvement over the present methods of core drilling, and by means of which the cuttings from the bottom of the hole, including the core, are brought to the surface as soon as they are detached without being mixed with cavings or washings already drilled through, and without withdrawing the tools. Provision is also made for drilling with the ordinary fish tail bit, when desired, as is done under the present systems of rotary drilling.

In carrying out the invention, a string of duplex inner and outer pipe is used in which the sections are connected by a special form of tool joint, and a special form of grief joint is used, whereby during the drilling operation water is introduced through the outer pipe under sufficient pressure to counteract the pressure outside the pipe and to cause a return flow through the inner pipe, whereby the cuttings are brought to the surface unmixed with any mud or cavings

from the side of the hole, so that the character and location of the various strata may be determined with the same accuracy as in the usual method of core drilling. Whenever necessary the special grief joint may be disconnected and the usual form of grief joint substituted, and mud may then be introduced through the inner pipe to mud up the sides of the well to prevent the escape of the water into the well, and to increase the specific gravity of the fluid outside of the drilling tool.

The invention also includes an improved drilling tool especially adapted for use in carrying out this method, but good results may also be obtained by using the usual type of core drill, in connection with the method herein defined.

The advantages of the invention and principles of its operation will be more particularly explained in the following description, which is to be read in connection with the accompanying drawings, which illustrate one way in which the invention may be carried out.

In the drawings:

Figure 1 is a sectional view of a well showing the apparatus in position for drilling.

Figure 2 is a diametric section through the lower portion of the apparatus, showing the improved tool joint and improved drill tool.

Figure 3 is a plan view of the drill tool.

Figure 4 is a horizontal section taken on the line 4—4 of Figure 2.

Figure 5 is a bottom plan view of the drill tool.

Figure 6 is a diametric section through the improved grief joint.

Figure 7 is a diametric section through the male member of the tool joint.

Figure 8 is a diametric section through the female member of the tool joint.

Figure 9 is a horizontal section taken on the line 9—9 of Figure 7.

Figure 10 is a plan view of the member shown in Figure 8.

Figure 11 is a diametric section showing the means for using the ordinary grief joint to mud up the hole.

In carrying out the present invention, as illustrated in the drawings, a duplex pipe line is used, consisting of outer and inner concentric pipe sections 1 and 2 connected end to end by tool joints, which are of novel

construction and form the subject matter of my co-pending application, Serial No. 690, 805, above referred to. Each tool joint consists of a male member 4, and a female member 5. Each member has internally threaded flanges 8 and 9, which engage the adjacent threaded ends of the next sections of the duplex pipe line. The members 4 and 5 have mating tapered portions 10 and 11 provided with interengaging tapered threads, and interengaging shoulders 12. The member 4 is provided with a central bore 13 which connects the inner pipe sections, and each of the members 4 and 5 have annular series of passageways 14, which lead from the annular spaces between the outer and inner pipe sections, and the abutting shoulders 12 are provided with continuous annular grooves 15 which register with each other so as to connect the several passageways 14 of the respective members of the joint, and consequently form a continuous passageway regardless of the relative positions of the respective members 4 and 5. It will be understood that the pipe sections 1 and 2 of each length of duplex pipe are cut to the same length so as to fit when joined together.

For carrying out the drilling operation, it is preferred to attach to the lower end of the pipe line a cutting tool 16 of special construction, as illustrated in Figures 2 and 5. This cutting tool is provided with concentric internally threaded flanges 17 and 18, adapted for threaded connection to the lower ends of the pipe sections 1 and 2. The working face of the tool is provided with an outer series of cutting teeth 19, the outer edges of which are flush with the body of the tool and an inner series of cutting teeth 20, both series of teeth being of the same length. The tool is provided centrally with a bore 21 adapted to register with the bore of the inner pipe. The points 22 of the teeth 20 extend downwardly and inwardly slightly beyond the periphery of the bore 21, so that the core which is cut by the tool may freely enter the bore, while the teeth 19 terminate short of the bore. The teeth 19 and 20 are preferably detachable, and any preferred means may be used for securing them to the face of the tool. As shown in the drawings, each tooth is set in a radial channel in the bottom face of the tool and is held by a screw 23, which is threaded into a socket in the tool. The cutting tool is provided with a series of passageways 24 in alignment with the annular space between the pipe sections 1 and 2, and branches 25 connect these passageways with the bore 21.

During the drilling operation, water is introduced under pressure through the outer pipe, and through the passageways 24. Since the teeth 19 are flush with the outer surface of the tool, it forms a comparatively

close fit in the well, so that there is little chance of the cavings mixing with the water. Moreover, the pressure of the water is sufficient to counteract the weight of the fluid outside the pipe, and a return flow is directed upwardly through the branches 25 and through the inner pipe, and immediately carries to the surface all cavings and fragments of core as soon as they are detached. Thus, the operator knowing the depth at which the tool is operating can accurately locate and determine the nature of the strata through which he is drilling.

In the usual grief joint, the water for the drilling operation is introduced through what corresponds to the inner pipe of the present construction. I have, therefore, provided a grief joint of special construction, as shown at 26. This grief joint may be rotated in the usual manner by means of a rotary table 41 splined to the grief joint as indicated at 42 and driven by a bevel pinion 43. It has an outer casing provided with a threaded lower end 27 adapted to be connected to the outer flange 8 of the upper male tool joint member 4, and an inner casing 28 with a lower threaded end 29 adapted to be connected to the inner flange 9 of the member 4. The upper end of the inner casing 28 is curved outwardly, and extends through the side of the outer casing 26, as indicated at 30. Thus, it will be readily understood that water may be introduced into the upper end of the casing 26 as it rotates, while the return flow is discharged through the outlet end 30 of the inner section 28. The upper curved portion of the section 28 is enlarged so as to permit the free passage of the core fragments. An annular trough 31 may be independently supported underneath the outlet 30, and provided with a discharge nozzle 32 having a hose connection. The trough 31, as shown in Figure 1, may be supported by cables 33 passing over sheaves 34, and provided at their other ends with weights 35.

Whenever it is desired to use a fish tail bit, or to mud up the hole, the grief joint 26 is disconnected and replaced by a grief joint of the usual type, as indicated at 36 in Figure 11, and to which either a water pump or mud pump may be connected. For making the connection between the grief joint 36 and the duplex string of pipe, the male member 4 of the uppermost tool joint is replaced by the member 37, which has a tapered nipple 38 adapted to be connected to the tapered threaded bore 11 of the female member 5. The member 37 also has an annular shoulder 39, which abuts against the upper extremity of the member 5, and forms a closure for the passageways 14 leading from the outer pipe. The upper end of the member 37 is internally threaded to receive the lower end of the grief joint 36, and an axial bore 40

is provided through the member 37, whereby mud or water under pressure may be introduced through the inner pipe.

While I have shown and described in detail the specific structure of one cutting tool which may be used in connection with the invention, it will be obvious that other forms of cutting tools may be used therewith. It will also be obvious that the specific construction of the special grief joint, used in the method herein described, may be modified without departing from the salient features of the invention. It is to be observed also that the same duplex string of pipe may be used in core drilling, or in drilling with a fish-tail bit, or in mudding up the hole. The same string may also be used for other purposes, which will readily occur to those familiar with deep well operations.

What is claimed is:

1. The method of drilling oil wells, which consists in rotating a cutting tool at the lower end of a duplex string of continuous inner and outer pipe, while water is introduced into the outer pipe under sufficient pressure to counteract the pressure outside the pipe, and temporarily discontinuing from time to time the introduction of water through the outer pipe, while forcing mud through the inner pipe into the space surrounding the outer pipe so as to cause the water, when its introduction through the outer pipe is resumed, to return through the inner pipe, which is the course of least resistance, carrying the cuttings, as fast as they are detached, to the surface, unmixed with any mud or cavings from the side of the hole.

2. The method of drilling oil wells, which consists in rotating a cutting tool at the lower end of a duplex string of continuous inner and outer pipe, while water is continuously introduced for a time into the outer pipe under sufficient pressure to counteract the pressure outside the pipe, and to cause a return flow through the inner pipe so that the cuttings, as fast as they are detached, are carried to the surface unmixed with any mud or cavings from the side of the hole, and then discontinuing the introduction of water through the outer pipe while mud is introduced through the inner pipe to mud up the sides of the well.

3. The method of drilling oil wells, which consists in rotating a core cutting tool at the lower end of a duplex string of continuous inner and outer pipe, while water is introduced into the outer pipe under sufficient pressure to counteract the pressure outside the pipe and to cause a return flow through the inner pipe, said inner pipe acting as a core barrel so that the core, as fast as it is detached, is carried to the surface unmixed with any mud or cavings from the side of the hole, and when necessary dis-

continuing the introduction of water through the outer pipe while mud is introduced through the inner pipe to mud up the sides of the well, and to increase the specific gravity of the fluid outside the drilling tool in order to prevent the escape of water into the well.

4. In an apparatus for drilling wells, the combination of a duplex string of concentric inner and outer pipe interconnected at each joint and having inner and outer passageways throughout its length, a core cutting tool having passageways therethrough, means for securing the tool to the lower end of the string of pipe with its passageways in alinement with the respective passageways through the inner and outer pipe, and a grief joint provided with an inlet passageway adapted to be connected to the outer pipe to admit water thereto, and having an outlet adapted to be connected to the inner pipe and discharging through the side of said inlet passageway.

5. In an apparatus for drilling wells, the combination of a duplex string of inner and outer pipe, means for attaching a cutting tool to the lower end thereof, and a grief joint provided with an inlet passageway adapted to be connected to the outer pipe to admit water thereto, and having an outlet adapted to be connected to the inner pipe and discharging through the side of said inlet passageway.

6. In an apparatus for drilling wells, the combination of a duplex string of concentric inner and outer pipe interconnected at each joint and having inner and outer passageways throughout its length, a core cutting tool having passageways therethrough adapted to form a continuation of the passageways through said pipe, means for securing the tool to the lower end of the string of pipe, a grief joint provided with inner and outer passageways, means for connecting the grief joint to the upper end of the string of pipe with its inner and outer passageways forming a continuation of the passageways through the string of pipe, the inner passageway of the grief joint having its upper end curved and extending through the wall of the outer passageway.

7. In an apparatus for drilling wells, the combination of a duplex string of inner and outer pipe interconnected at each joint, means for attaching a cutting tool to the lower end thereof, and a tool joint attachable to its upper end provided with means for closing the passageway through the outer pipe, said joint having a central bore to aline with the inner pipe and terminating in an internally threaded flange for the attachment of a grief joint having a single passageway.

8. In an apparatus for drilling wells, the combination of a duplex string of concen-

tric inner and outer pipe interconnected at each joint, a core cutting tool having passageways adapted to aline with the passageways through the duplex pipe, means for
5 securing the tool to the lower end of the pipe, a grief joint provided with an inlet passageway adapted to be connected to the outer pipe to admit water thereto and having an outlet adapted to be connected to the
10 inner pipe, said outlet having its upper end curved and extending through the side of the inlet passageway, an annular trough adapted to surround the grief joint beneath its outlet, and means for independently sup-
15 porting the trough in that position.

9. A grief joint for use with a duplex string of inner and outer pipe, comprising an outer casing and an inner casing with their lower ends threaded for connection to
20 the upper ends of the duplex string of pipe, the inner casing having its upper end curved and extending through the wall of the outer casing.

10. A grief joint for use with a duplex
25 string of inner and outer pipe, comprising an outer casing and an inner casing, with their lower ends concentric and threaded for connection to the upper ends of the duplex string, the inner casing being curved
30 at its upper end and extending through the wall of the outer casing, said curved portion being enlarged so as to permit the passageway of elongated fragments of the core.

11. A grief joint for use with a duplex string of concentric inner and outer pipe
35 and having a passageway extending from its upper end for introducing water under pressure into the outer pipe of the string, means for receiving a return flow from the inner pipe and discharging the same through
40 its side wall, a circular trough adapted to surround the grief joint, and independent means for supporting the circular trough beneath the point of discharge, so as to continuously receive the material discharged
45 while the grief joint is rotated.

12. A grief joint for use with a duplex string of inner and outer pipe, comprising an outer casing provided with means for
50 connection to the outer pipe of the string, an inner casing provided with means for connection to the inner pipe of the string, said inner casing having its upper end enlarged and curved outwardly and extending
55 through the wall of the outer casing, an annular trough adapted to surround the outer casing, and independent means for supporting the outer trough beneath the outer end of the inner casing for receiving the material discharged therefrom while the grief
60 joint is rotated.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature.

HAMPTON A. STEELE.