Oct. 19, 1937. J. C. KARCHER 2,096,279

INSULATED PIPE CONNECTION

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FIG. 1.

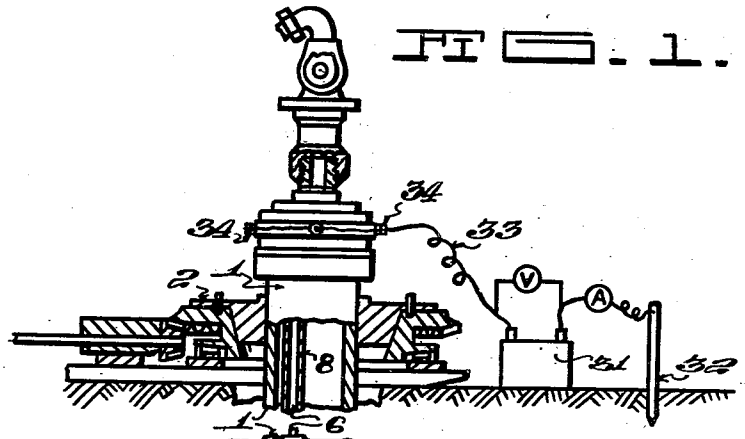
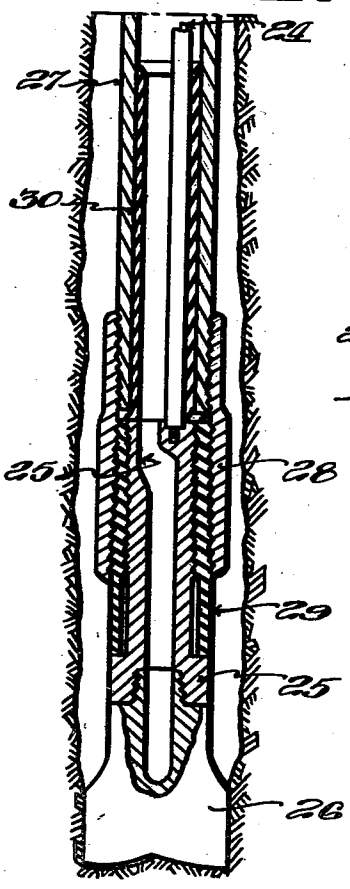


FIG. 2.



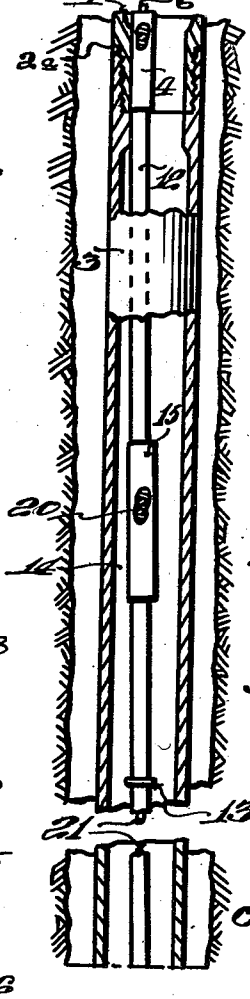
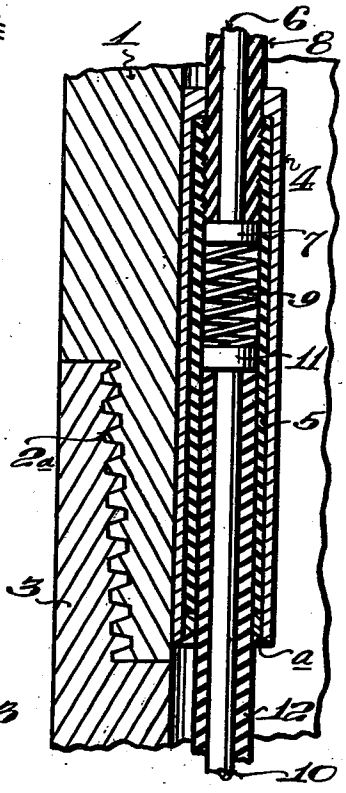


FIG. 3.



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FIG. 4.

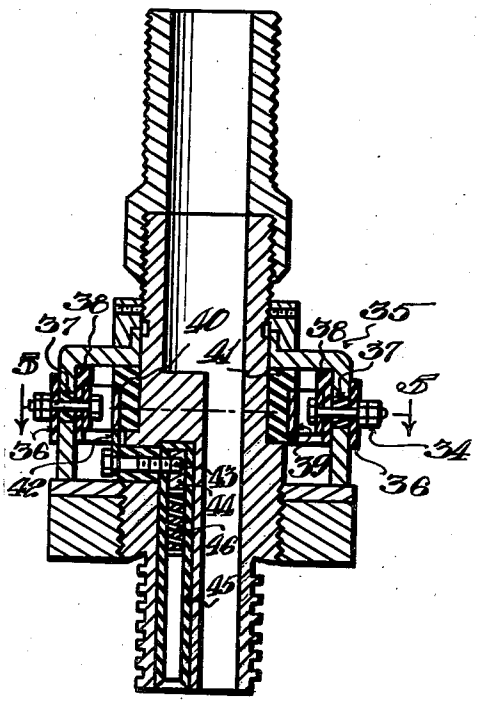


FIG. 5.

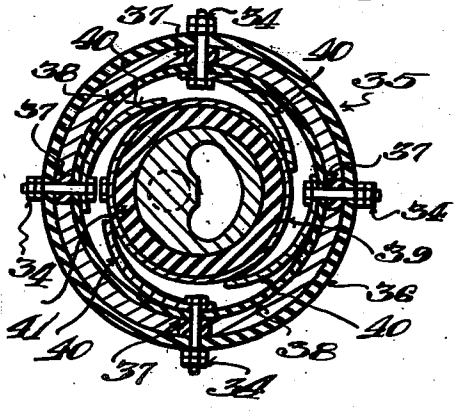
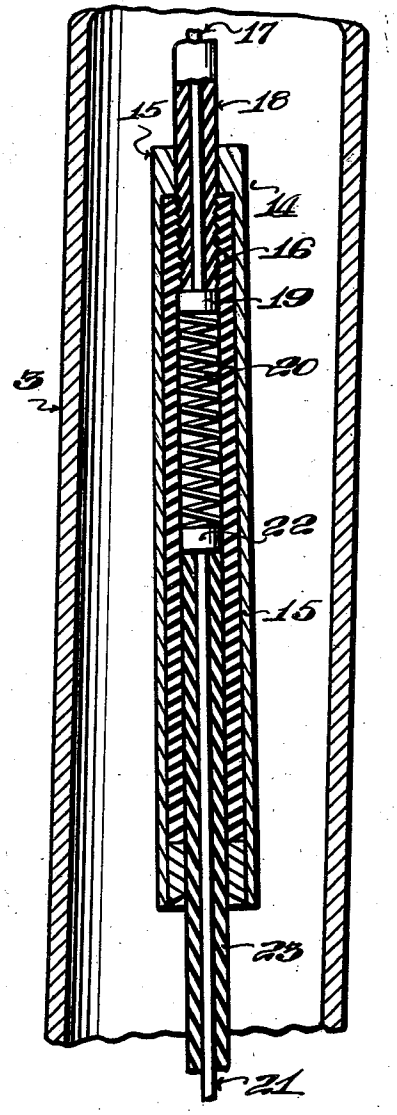


FIG. 6.



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UNITED STATES PATENT OFFICE

2,096,279

INSULATED PIPE CONNECTION

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Application March 26, 1935, Serial No. 13,043

5 Claims. (Cl. 255—28)

This invention relates to new and useful improvements in insulated pipe connections and it has particular reference to such connections adaptable to rotary drill pipe.

The principal object of the invention is to render practicable the method and means for so connecting drill pipe that an electrical current may be conducted through an electrical conductor within the drill pipe into the earth, and that such current may be maintained during the process of drilling for the purpose of locating or indicating the presence of oil, gas and other natural resources within the earth.

Another object of the invention is to provide a simple, economical and practical drill stem connection which is likewise serviceable under any and all conditions.

With the foregoing objects as paramount, the invention has particular reference to its salient features of construction and arrangement of parts, which will become manifest as the description proceeds, taken in connection with the accompanying drawings, in which:—

Figure 1 is a vertical section of a drill stem assembly showing the invention operatively assembled.

Figure 2 is a continuation of Figure 1.

Figure 3 is an enlarged view of the electrical connection between the sections of drill stem.

Figure 4 is a vertical section through the upper section of the Kelly joint at the point of connection of the ground current.

Figure 5 is a transverse section on lines 5—5 on Figure 4, and

Figure 6 is a fragmentary section of a drill pipe showing a longitudinal section of a collapsible sleeve, to facilitate the jointing and disjointing of sections of pipe.

Drill pipe used in rotary drilling of wells in search of oil, gas and other natural resources within the earth is made up in sections, common lengths used in oil well drilling varying from twenty to thirty feet. In order to provide that an insulated electrical conductor may be run down the drill pipe and properly connected into a circuit as successive sections of drill pipe are added, it is paramount that a suitable insulated connection for the electrical circuit be provided at the joint between any two adjacent sections. This connection must be so constructed that the electrical connection will be completed when the sections of drill pipe are joined together; and the electrical connection maintained during the process of drilling. The electrical conductor at the joint must also be properly insulated from the drill pipe and the drilling fluid.

Referring primarily to Figure 1, 1 represents the Kelly joint of a rotary rig, which joint passes through the drilling table 2 of the drilling assembly. The Kelly joint 1 is threadably connected at 2a to the drill pipe 3 as shown.

Because of the necessity for separating the joints of drill pipe when the pipe is taken apart, or conversely because of the necessity for joining the drill pipe when the pipe is reassembled, it is necessary that an electrical conductor within the drill pipe be joined or disjoined as the case may be, simultaneously with the similar operation upon the sections of drill pipe.

The electrical coupling adaptable to be used between the Kelly joint and drill pipe, as well as between the various joints of drill pipe is best shown in Figure 3, wherein 4 represents a metal sleeve, preferably of steel, which is attached by welding or other suitable means to the inside wall of the Kelly joint 1 or drill stem 3. Within the steel sleeve 4 is inserted an insulating tube 5, preferably of synthetic resin-impregnated cloth. The conducting rod 6 is provided with a metallic ferrule 7, and the upper end of the insulating sleeve 5 is threaded to receive the insulating covering 8 which surrounds the conductor 6. A coiled spring 9 is attached to the ferrule 7 by welding or other suitable means, thus affording an electrical connection between the conductors at the joints of the drill pipe.

The upper end of the conducting rod 10 carries a metallic ferrule 11, similar to the ferrule 7, and the interior of the sleeve 5 and exterior of the covering 12 on the conducting rod 10 are of such size that the insulated rod 10 slides easily into the insulating sleeve 5.

In assembling the joint, the section 3 of drill pipe is supported on the floor of the drilling rig while the Kelly joint 1 or another section of drill pipe is lowered so that it may engage the threads of the section of drill pipe 2a. It will be noted that before the bottom end of the Kelly joint or drill pipe section is in line with the upper end or female thread of the section 3, the ferrule 11 may be readily inserted in the sleeve 4, the lower end of this sleeve being interiorly bevelled as shown at a in Figure 3 to aid in the assembling operation. As soon as the ferrule 11 is guided into the sleeve 4, the upper joint is lowered until the threads of the two joints of pipe are engaged, after which the upper section is turned until the threads are tightly screwed together.

Since the sleeve 4 is not concentric with the

drill pipe, it will be noted that the upper end of the rod 12 will be obliged to sweep around inside of the upper end of the drill pipe 3, and therefore must be free to permit this motion. In order that this can be accomplished without breaking the rod 10, and at the same time providing for its support within the drill pipe 3, a clamp 13 is so attached to the interior of the drill pipe 3 that the rod 12 is permitted to flex the necessary amount without breaking. With standard 4" rotary drill pipe and a ¼" copper rod 10, having an outside diameter of ½" for the insulated covering 12, it has been found that satisfactory performance is obtained if the clamp 13 is located approximately 7 feet 6 inches below the threads 2a.

The upper end of the rod 6 is similar in construction to the upper end of the rod 10 shown in Figure 3, and likewise the lower end of the drill pipe 3 is fitted up in the same manner as the lower end of the Kelly joint or other section of drill pipe, so that successive joinings of the conductors can be made in the manner above described as additional sections of drill pipe are added.

When extra heavy drill pipe is used, the inserting of the ferrule 11 is greatly facilitated by the addition of a collapsible sleeve 14, shown in Figures 1 and 6. This sleeve is similar in construction to the electrical couplings attached to the lower end of the Kelly joint and drill pipe sections. Referring to Figure 6 it will be noted that the collapsible sleeve 14 is comprised of an outer steel sleeve 15 within which reposes an insulating liner 16.

The conducting rod 17 is suitably insulated by a covering 18 which is threaded into the insulating liner 16 as shown. The conducting rod 17 is provided with a ferrule 19, to which is attached a spring 20. The lower conducting rod 21 is provided with a ferrule 22 and is suitably insulated by the covering 23, the various parts being so arranged that the lower insulated rod 21 and ferrule 22 are free to slide within the insulating liner 16. It is pointed out that the sleeves 14 are not attached to the drill pipe, but are free to move therein, and that the sleeves 14 are considerably longer than the couplings attached to the lower ends of the drill pipe sections.

With the arrangement above described, it is possible to provide for the ferrule 11 on the rod 10 to extend substantially above the end of the drill pipe section 3, thereby facilitating the making of an electrical connection when the end of a drill pipe section is swung over the pipe section 3. During this operation the rod 10 is pushed downward, collapsing the spring 20. The upper section of drill pipe can then be swung over the lower section 2 to such a position that the lower end of the sleeve 4 will be coaxial with the ferrule 11 on the rod 10, at which time the rod 10 can be released, permitting the spring 20 to expand and force the end of the rod 10 into the insulating sleeve 5, thus completing the electrical connection before the upper section of drill pipe has been lowered into the drill pipe 3.

The connection of the conducting rods with the drill bit is shown in Figure 2. The lower end of the conducting rod 24 is threadably secured to a metallic drill connection 25, to which a bit 26 is connected as shown. Torque is transmitted from the drill stem 27 to the bit 26 through the medium of the metallic sleeve 28 and insulating sleeve 29 which are threaded as shown.

It will be noted that current may be led into the earth through the drill bit 26 by the arrangement above described, but it will also be noted that current can flow back to its source by way of the drilling fluid above the drill connection 25 and the drill stem 27. In order to reduce this latter current to a minimum, an insulated sleeve 30 is provided, which is made relatively long in order that the resistance of this path will be much greater than the resistance to the earth through the drill connection 25 and the bit 26.

The apparatus for leading current into the drill stem assembly is shown in Figures 1, 4 and 5, current being supplied by a battery 31, the return to which is accomplished by means of a suitable ground 32. Voltage and amperage readings may be taken during the progress of drilling with the instruments arranged as shown in Figure 1.

Current from the battery 31 is led into the assembly through wire 33, which connects to a plurality of terminals 34 spaced around the periphery of a slip ring assembly 35, shown in detail in Figures 4 and 5. These terminals are insulated from the stationary metallic parts of the slip ring unit by an outer insulating ring 36, insulating bushings 37 and an inner insulating ring 38. Current is conducted to a slip ring 39 through a series of brushes 40. The slip ring 39 is insulated from the drill stem assembly by an annular insulating ring 41. Referring to Figure 4 it will be seen that the slip ring 39 is electrically connected by a conducting link 42 to an insulated cap screw 43, which serves to conduct current to a metallic segment 44 which is insulated by a bushing 45. A spring 46 is welded to the segment 44, thereby enabling current to be conducted from the source to the interior of the drill stem, connection with the spring 46 being effected by a conductor having a ferrule as illustrated in Figure 3.

Manifestly, the construction as shown and described is capable of some modification and such modification as may be construed within the scope and meaning of the appended claims is also considered to be within the spirit and intent of the invention.

What is claimed is:

1. An apparatus for exploring bore holes including in combination with a drill stem, insulated upper and lower electrical conductors disposed within successive sections of said drill stem, said conductors each having a length less than that of a drill pipe section, each of said lower conductors being rigidly mounted adjacent its lower end to the corresponding drill pipe section, an insulated sleeve carried by the upper end of each of said lower conductors and slidably mounted thereon, a second insulated conductor rigidly attached to each of said sleeves, conductor spring means within each of said sleeves whereby to urge each of said upper conductors to project beyond the end of the pipe section, and means for successively connecting one of said first conductors to one of the second conductors in an adjacent section of drill pipe.

2. An apparatus for exploring bore holes including in combination with a drill stem, insulated upper and lower electrical conductors disposed within successive sections of the drill stem, said conductors each having a length less than that of a drill stem section, each of said lower

conductors being rigidly mounted adjacent its lower end to the corresponding drill pipe section, an insulated sleeve carried by the upper end of each of said lower conductors and slidably mounted thereon, each of the upper insulated conductors being rigidly attached to its corresponding sleeve, and means within each of said sleeves whereby to urge the conductor attached thereto to project beyond the end of the drill pipe section.

3. Apparatus for conducting an electrical current inside a rotary drill pipe including an insulated electrical conductor mounted within each section of said drill pipe, said conductor having a length less than that of a pipe section, a second conductor slidably mounted relative to said first conductor, and means to cause said second conductor to project beyond the end of the pipe section when said pipe section is disconnected.

4. Apparatus for conducting an electrical current inside a rotary drill pipe including an insulated electrical conductor mounted within each section of said drill pipe, said conductor having a length less than that of a pipe section, a second insulated conductor slidably mounted relative to said first conductor, spring means to cause said second conductor to project beyond the end of the pipe section when said pipe section is disconnected from a companion section, and spring means for effecting electrical connection at the joints of said drill pipe.

5. Apparatus for conducting an electrical current inside a rotary drill pipe including in combination with a drill bit insulated from said drill pipe, an insulated conductor mounted within each section of said drill pipe, said conductor having a length less than that of a pipe section, a second insulated conductor slidably mounted relative to said first conductor, spring means to cause said second conductor to project beyond the end of the pipe section when said section is disconnected, means for effecting electrical connection at the joints of said drill pipe, and means for electrically connecting said conductors to said insulated bit.

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