Feb. 4, 1930. A. B. CROSS ET AL 1,745,567

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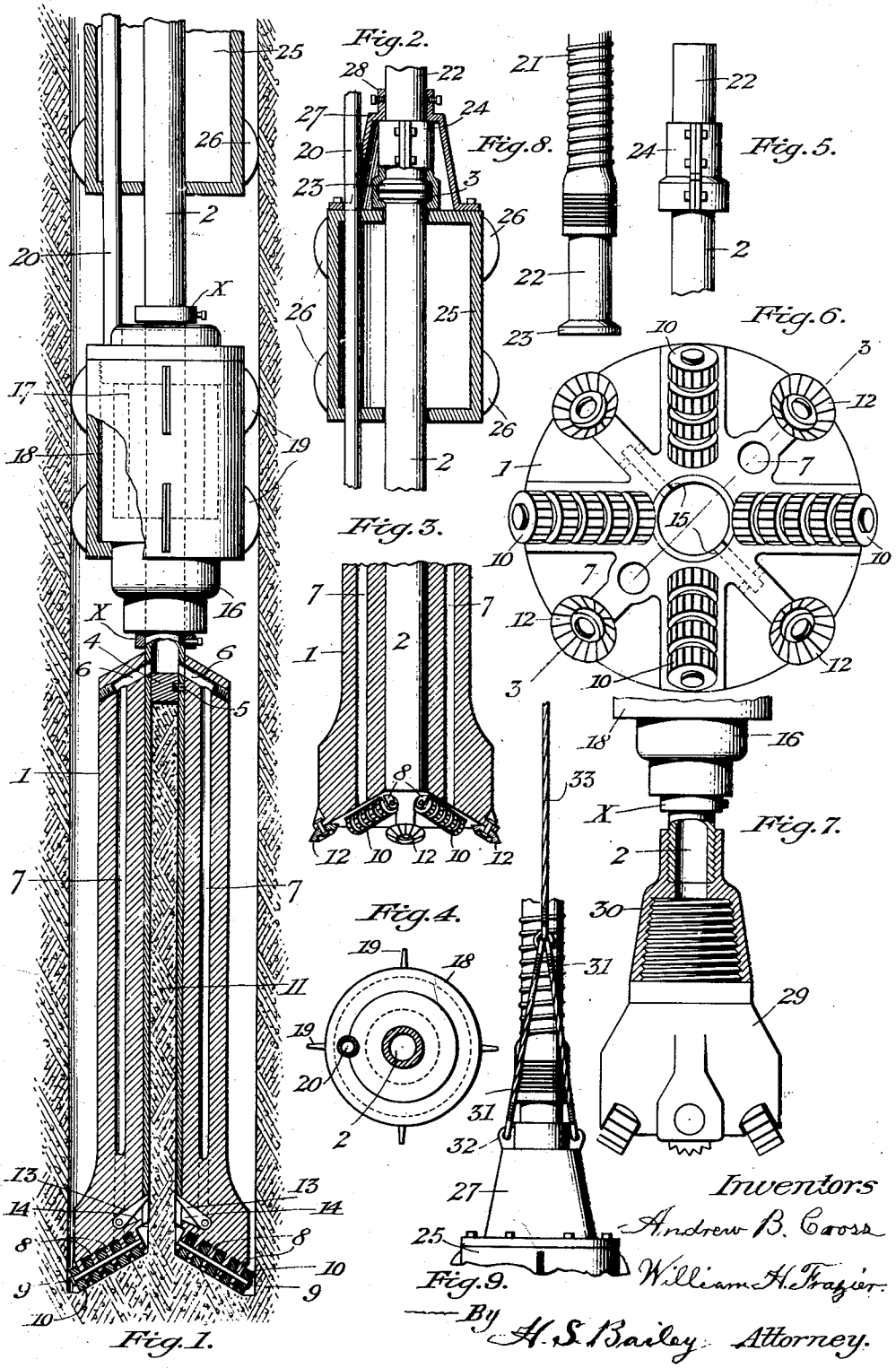
Filed April 26, 1928



Patented Feb. 4, 1930

1,745,567

UNITED STATES PATENT OFFICE

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MEANS FOR OPERATING WELL-BORING DRILLS

Application filed April 26, 1928. Serial No. 273,015.

Our invention relates to improvements in means for operating well-boring drills.

The main object of the invention is to provide an operating motor for the drill head which is connected to the drill stem immediately above the drill head, the drill stem being of comparatively slight length and being rotatably connected to the lower end of a non-rotatable pipe or hose, whereby the motor moves downward with the drill head, so that the point at which the power is applied to the drill stem is always at the same distance above the drill head throughout the depth of the well, means being provided for preventing rotation of the motor in the well, and means being provided to supply actuating fluid to the motor.

A further object of the invention is to provide a drill head having a short, motor-driven drill stem, the upper end of which is swiveled to the lower end of a water hose, whereby a fixed distance between the motor and drill head is maintained throughout the well-boring operation, and the rotative power from the motor is applied to the short drill stem, only, and thus directly to the drill head, which is therefore operated as effectively at a great depth, as at a slight depth, without the necessity of an increase in the motive power, guides being provided for holding the lower end of the hose and also the motor against rotation as they descend, said motor being connected with a source of steam or compressed air.

These objects are accomplished in the manner illustrated in the accompanying drawings, in which:—

Fig. 1 is a vertical sectional view illustrating the improved manner of operating a well-boring drill by a motor directly connected therewith, a core drill being shown.

Fig. 2 is a vertical sectional view through the guide which centers the lower end of the water hose where it is coupled to the drill stem and which holds the said hose against rotation.

Fig. 3 is a vertical sectional view, through the lower end of the drill head, shown in Fig. 1 on the line 3—3 of Fig. 6.

Fig. 4 is a top view of the motor and its guide.

Fig. 5 is a side view, showing the coupler which connects the lower end of the water hose with the drill stem.

Fig. 6 is a bottom view enlarged of the drill head, shown in Figures 1 and 3.

Fig. 7 is a side view showing an ordinary drill head in connection with the motor.

Fig. 8 is a side view of the lower end portion of the water hose to which the drill stem is rotatably connected, and

Fig. 9 is a side view showing the manner of securing the lifting cable to the drill stem centering device.

Referring to the accompanying drawings:—

The numeral 1 designates a drill head, which may be of any preferred character or design, but which, in the present case is a drill head adapted for the cutting and removing of cores to determine the nature of the formation through which a well is being drilled. The drill head is rigidly mounted on a hollow drill stem 2, which extends from the bottom of the drill head to a point a relatively short distance beyond the upper end of the same, and terminates in an annular flange 3, as shown in Fig. 2. A plug 4 is inserted in the drill stem and is held therein at a point within and near the upper end of the head, by a set screw 5. This plug determines the length of the cores to be cut, as will be understood by reference to Fig. 1. Lateral water passages 6 are drilled through the upper end of the head and through the drill stem, above the plug 4 and these passages are intersected by vertical passages 7 which extend down through the lower end of the drill, thus permitting water to pass down from the drill stem and out through the lower end of the drill head. The lower end of the drill head is formed with a conical depression, and the face of this depression is formed with four equi-distant sets of spaced apertured ears 8, and a bolt 9 is passed through the apertures of each set of ears, the bolts radiating from the axial center of the head. Upon each bolt 9 is mounted a set of rotary cutters 10, the cutters of two of the alined bolts traveling in different paths from the cutters on the other two alined bolts, so as to cut away the

entire surface below the head, excepting a central portion which enters the drill stem in the form of a core 11. Side cutting rollers 12 are mounted on the bottom end of the head midway between the rows of cutters 10, and these cutters travel in a path of greater diameter than that of the head so as to provide ample clearance for the head. Gravity cutting dogs 13 are pivotally mounted in recesses 14 in the lower end of the drill head, and project through slots 15 in the lower end of the drill stem. These dogs are inoperative during the core-forming operation, but when the drill head is lifted slightly, the dogs grip the core, and, as the lifting is continued, the head being rotated at the same time, the dogs will cut through the core and pass under its lower end, so as to support the core while the head is being lifted out of the well. As the head is lifted, a space will be formed between the upper end of the core and the block 4, and when the core is pushed up against the block, the dogs can be swung back into the recesses 14, thus permitting the core to drop from the drill stem.

Upon the drill stem 2, immediately above the drill head, is mounted the operating motor, which is in the form of a turbine 16, which may be operated either by steam or compressed air. These turbines are of a style in common use for various purposes, such as for operating boiler tube cleaners, and therefore a detail description and drawings of the turbine is deemed unnecessary. The turbine is provided with a rotor 17, as indicated by dotted lines in Fig. 1, through which the drill stem passes, and is rigidly connected therewith. As used for well boring purposes, the turbine is encased in a cylindrical jacket 18, which is non-rotatably secured to the turbine casing and which is of slightly less diameter than the diameter of the well to be drilled, and the jacket is provided with laterally projecting fins 19, which engage the wall of the well as the drill head descends, and prevent rotation of the motor. The jacket forms a guide for the drill head, whereby it is prevented from wabbling and is maintained in a central position with respect to the wall of the well. A supply pipe 20 extends from the motor to a steam or air supply, and is made up of sections, which are added as the well increases in depth. The motor is held against endwise movement on the drill stem, by collars X, which are secured to the stem above and below the motor. The upper end of the drill stem 2 is rotatably connected to the lower end of an armored hose 21 in the following manner:—The lower end of the hose has secured therein, a short tube 22, the lower end of which terminates in a flange 23, similar to the flange 3 on the upper end of the drill stem, and the flanged ends of the tube 22 and the drill stem are connected by a coupler 24 comprising two half round sections which are bolted together around the tube 22, and are recessed or enlarged to receive the flanges 23 and 3, as shown by Fig. 2, so that the drill stem is thereby rotatably connected to the lower end of the hose. A cylindrical guide 25 surrounds the drill stem immediately below the coupler 24, and is of the same diameter as the motor jacket 18, and is also provided with lateral fins 26 for engaging the wall of the well. A hollow bell shaped support 27 is bolted to the upper end of the guide 25, and the top of this support rests upon the top edge of the coupler 24, and terminates in a short neck 28, which is rigidly secured upon the tube 22. The drill stem passes through axial holes in the upper and lower ends of the guide 25, so that the upper end of the drill stem is prevented from wabbling and will therefore turn freely in the coupler 24 on the lower end of the hose 21, which is held against rotation by its connection with the guide 25. The supply pipe 20 also passes through the guide 25, and is thus held against vibratory motion at its connection with the motor.

In Fig. 7 a common form of drill head 29 is shown in connection with the motor, and this drill head may be used in connection with a reamer, or it may be secured directly to the drill stem, as shown, and when thus used, an internally threaded socket member 30 is screwed upon the lower end of the drill stem, and the shank of the drill head is screwed into the socket member. In other respects, the arrangement is the same as that above described.

Cables 31 are connected to ears 32 on the bell shaped support 27, and these cables are connected to an operating cable 33 which extends up through the well, to an operating drum in the usual manner, thereby to lift the drill and motor from the well.

In operation, the drill head, the motor and the guide 25 are assembled in the manner previously described, the drill stem is coupled to the lower end of the hose 21 and the supply pipe 20 is connected with an air or steam source. If a core drill is used, the same is lowered into a previously drilled hole, the fins on the motor jacket or guide 18, and on the guide 25 engaging the wall of the hole. When the drill head strikes the bottom of the hole, air or steam is admitted to the motor and the drill stem and drill head secured thereon are rotated. At the same time, water is passed down through the hose to the drill stem and thence through the passages 6 and 7 and out through the lower end of the drill head. The operation is the same for the common form of drill. As the motor is secured upon the drill stem, just above the drill head, the power applied is the same at all depths of the well, and is direct, as there is no intervening length of drill stem between the motor and drill head. The guides 18 and 25

center the drill head with respect to the well and prevent binding of the drill stem in the coupling which connects it with the end of the water hose. By the direct application of power to the drill head at all depths of the well, less power is necessary in operating the drill head, than is necessary where that power is transmitted through a continuously increasing length of drill stem, as in the present manner of operation, and therefore the drilling, by the improved motor connection, can be more cheaply and quickly accomplished, than by the method at present employed.

Having described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In well drilling mechanism, the combination of a hollow drill stem and a drill head mounted thereon having passages connected with said hollow stem, a turbine having a rotor axially mounted upon and secured to said hollow stem, means for preventing rotation of said turbine within the well, comprising a jacket rigidly mounted on the turbine and having fins for engaging the wall of the well, means for supplying actuating fluid to said turbine, a hose to extend down, in the well, a coupler for rotatably connecting the upper end of said drill stem to the lower end of said hose, a cylindrical guide surrounding the upper portion of said drill stem, having fins for engaging the wall of the well thereby to prevent rotation of said guide, a support rigidly connecting said guide, and the lower portion of said hose above said coupler, and a lifting cable connected to said support.

2. In well-drilling mechanism, the combination with a hollow drill stem, a drill head on said stem, means on said stem for rotating the same, a hose and a coupler connecting the upper end of said stem and said hose, of a cylindrical member loosely surrounding the upper portion of said stem and having fins for engaging the wall of the well; a hollow bell-shaped support connected to the upper end of said cylindrical member and to the lower end portion of said hose and enclosing said coupler, apertured ears on said bell-shaped member, and a lifting cable connected to said ears.

In testimony whereof, we affix our signatures.

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