J. DARLING.

WELL DRILLING APPARATUS.

APPLICATION FILED DEC. 23, 1912.

1,087,353.

Patented Feb. 17, 1914.

2 SHEETS—SHEET 1.

Fig. 4.

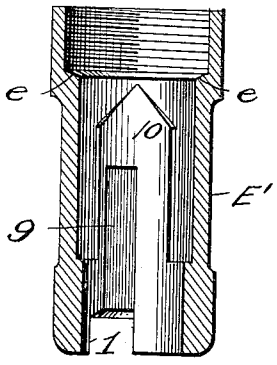


Fig. 4.a

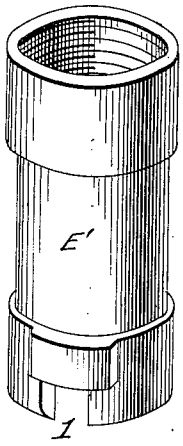


Fig. 4.b

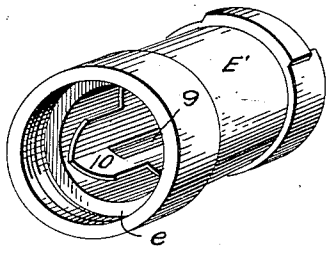


Fig. 1.

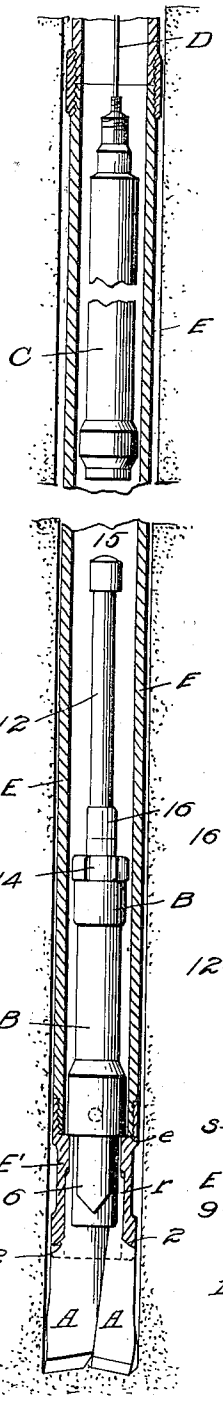


Fig. 5.a

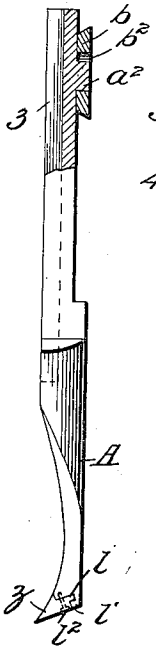


Fig. 5.

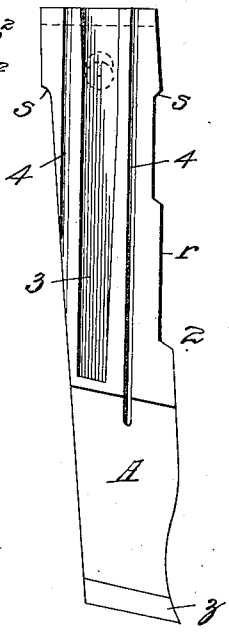
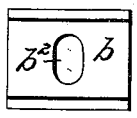


Fig. 5.b



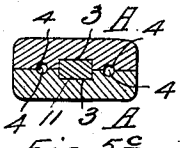
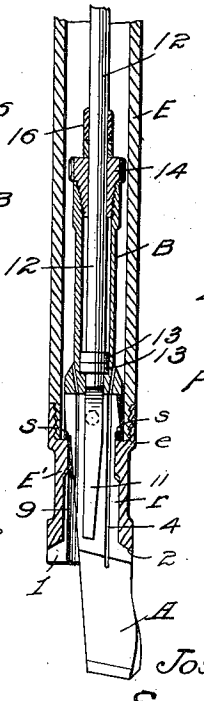


Fig. 5.c

Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

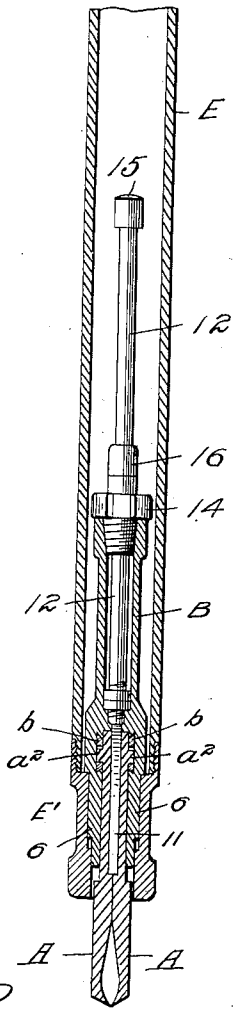


Fig. 6.

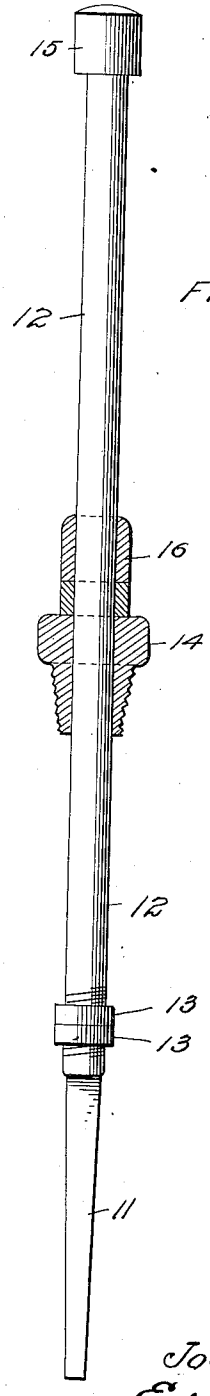
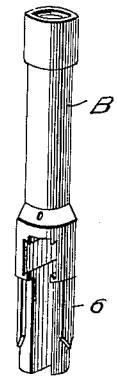


Fig. 7.



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UNITED STATES PATENT OFFICE.

JOSEPH DARLING, OF CHICORA, PENNSYLVANIA.

WELL-DRILLING APPARATUS.

1,087,353. Specification of Letters Patent. Patented Feb. 17, 1914.

Application filed December 23, 1912. Serial No. 738,213.

To all whom it may concern:

Be it known that I, JOSEPH DARLING, a citizen of the United States, residing at Chicora, in the county of Butler and State of Pennsylvania, have invented certain new and useful Improvements in Well-Drilling Apparatus, of which the following is a specification.

In the patent granted me December 12, 1911, No. 1,011,324, I have shown and described a well drilling apparatus comprising a rotary drill tube having at its lower end expansible drill bits, which latter may be inserted into and removed from the drill tube without removing the long drill tube from the well, an important part of which apparatus consisted of a separable socket grip which was made to send the drill bits down into the well through the drill tube, expand and lock them to the bottom of the drill tube and then become entirely detached therefrom and be removed entirely from the well, and in which the same socket grip, by its attached rope, may be sent down into the well to unlock and remove the drill bits when the latter are required to be taken out.

My present invention relates to this same apparatus and consists in a novel construction and arrangement of the lower portion of the drill tube, the drill bits and their coacting parts, whereby the possible dropping out and loss of the drill bits is prevented, the wear on the fulcrum support of the drill bits provided for, water courses provided through the drill bits, and the taking up of wear on the drill expanding device is provided for.

Figure 1 is a vertical section of the rotary drill tube shown in the well, in connection with the drill bits, the drill head and the separable socket grip which in general features are similar to my former invention. Fig. 2 is a vertical sectional view through the lower end of the drill tube and drill head. Fig. 3 is a vertical section at right angles to that shown in Fig. 2. Figs. 4, 4^a and 4^b are views of the lower section of the drill tube, Fig. 4 being a vertical central section and Figs. 4^a and 4^b being perspective views taken, respectively, from the side and end. Figs. 5 and 5^a are enlarged detail views of the drill bits, Fig. 5 being an inside face view and Fig. 5^a being an edge view partly in section. Fig. 5^b is a detail side view of the separable fulcrum block on which the drill bits are hung and Fig. 5^c is a cross section through the shanks of the two drill bits when in working position. Fig. 6 is an enlarged detail of the drill seating rod, and Fig. 7 is a perspective view of the drill head shown detached.

In the drawing, Fig. 1, E is the rotary drill tube and B the drill head carrying the drill bits A A, which latter are adapted to be lowered into the rotary drill tube and then be expanded and locked to drilling divergence, or be removed from the well and all without removing the drill tube from the well. The accomplishment of this object is attained by the same means already fully set forth and claimed in my previous patent referred to.

For the purposes of the present invention it will be sufficient to say that a rod 12 with head 15 is connected to the drill head B below and is adapted to be grabbed by a hollow and separable socket grip C lowered on a rope, the construction being such that the socket grip may be made either to seize or release the headed rod 12 at the will of the operator.

My present invention has to do with the lower section E′ of the drill tube, the drill bits, and the drill head and their connected parts in accomplishing the objects of my present invention hereinbefore pointed out.

The lowest drill tube section E′ is formed interiorly with two inwardly projecting enlargements 10, Figs. 4 and 4^b, each of which extends about one-quarter around the drill tube section and whose pointed ends are at the top and nearly in vertical alinement with the interior longitudinal groove 9 and coinciding notch 1 at the bottom of the tube section E′. Within this tube section fits the drill head B, Fig. 7, which has at its lower end two forks between which the drill bits A A of similar shape are hung, as in Fig. 3. On the outside of the lower ends of the forks are formed projections 6, Fig. 7, having triangularly pointed lower ends which, when the drill head is inserted in the well, engage the tops of the triangular enlargements 10, Fig. 4, of the lower drill tube section and turn the drill head about its vertical axis until the drill bits shall coincide with the plane of the grooves 9 and notches 1 of the tube section, so as to be capable of expansion therein to lock the bits to the tube section. This does not differ

materially from the construction and principles of action set forth in my present patent.

An important object of my present invention is to prevent the drill bits from dropping out of the drill tube if their fulcrum support is worn out or broken. For this purpose the inner surface of the lower section of the drill tube is formed near the top with an annular shoulder *e*, see Figs. 4, 4[b] and Figs. 1 and 2, and the top of each drill bit is formed with a relatively narrow neck with an enlarged head above it, forming outwardly projecting shoulders *s s*, see Figs. 2 and 5. The shoulders of the drill bits overhang the shoulder of the drill tube section, so that the drill bits cannot drop down and out, even if the fulcrum support of the drill bits is worn out or broken. The shoulder *s* of the drill bit does not normally rest upon the shoulder *e* of the drill tube, but is a little above it, so as to give freedom of action for the bits in expanding and collapsing, but if the fulcrum support is lost then the bit shoulder *s* catches against the tube shoulder *e* and prevents the bits from dropping out.

For hanging the drill bits within the forks of the drill head the shanks of the drill bits are made longer than heretofore and on the outer faces of the upper ends are formed integral pins or studs a^2, Fig. 5[a]. Each is received in the elongated hole b^2 of a fulcrum block *b*, see Fig. 5[a] and Fig. 5[b]. The fulcrum blocks are preferably of dovetail form and slide laterally into corresponding dovetail grooves in the inner faces of the forks of the drill head shown in Figs. 3 and 7, forming coaxial pivots for the drill bits. This makes a strong fulcrum bearing which is removable when worn and may be replaced by a new one, the oblong hole giving room for the slight change in position which the bits require in expanding and collapsing.

For expanding the drill bits after they are in the plane of their locking seats the driving rod 12 has a longitudinally extended lower end 11, of rectangular cross section, which enters longitudinal grooves 3, 3 in the adjacent faces of the shanks of the drill bits, see Figs. 2, 5 and 5[c], one-half of the rod in each drill bit shank. As the grooves 3 are at an incline to the longitudinal axis of the drill bits, when the rod is driven down it expands the drill bits to locking position in their seats in the lower drill tube section in the same general way as in my former patent, except that in this case the grooves 3 are slightly tapered, largest at the top, and the rod extension 11 is tapered in one plane, as seen in Figs. 2 and 6.

A stop on the drive rod is formed by two jam nuts 13, 13, which, see Figs. 2 and 6, are screwed onto rod 12 and are susceptible of being adjusted higher thereon in case there is looseness between the key 11 and the grooves 3, 3, in which case by adjusting the stop nuts 13 higher the key 11 is allowed to penetrate farther downward and take up said looseness.

On the inner faces of the two drill bits are formed parallel to the grooves 3 longitudinal water ways 4, 4, Fig. 5, and when the drill bits are expanded to working position these grooves come into coincidence, as seen in Fig. 5[c], and allow water to flow down to the cutting edges of the drill bits to prevent clogging.

At the bottom of each drill bit is a detachable cutting point *z*, see Figs. 5 and 5[a]. This is applied to the bottom end of the drill bit by screws l^2 arranged substantially longitudinal to the drill bit and this detachable edge has at its end opposite the cutting edge a lip *l* that extends, in angular relation to the longitudinal axis of the drill, over an underlying lip *l'* of the drill bit of similar angular relation to the drill. This avoids tilting and relieves the strain in drilling and also presents the cutting edge in better cutting relation to the rock.

I claim:

1. A well drilling apparatus of the kind described, comprising a rotary drill tube, a drill head carrying two pivoted drill bits of similar shape adapted to be interlocked with the drill tube, said drill tube being formed with an inwardly projecting shoulder on the inside and the drill bits being each formed at its upper end with a relatively narrow neck having an enlarged head above it adapted to extend over and be caught by the shoulder of the drill tube in any downward movement.

2. A well drilling apparatus of the kind described, comprising the lower section of the drill tube having an inwardly projecting shoulder and two drill bits of similar shape each having at its upper end a relatively narrow neck with an enlarged head above it adapted to engage the shoulder of the drill tube and hold the drill bits against dropping out.

3. A well drilling apparatus of the kind described, comprising a rotary drill tube having interlocking seats for the drill bits in its lower end, a drill bit head with downwardly projecting forks, laterally removable fulcrum blocks arranged in the inner faces of the forks and formed with fulcrum bearings, drill bits having fulcrum studs on the outer faces of their shanks entering the fulcrum bearings of the blocks, and means for expanding the drill bits into the interlocking seats of the drill tube.

4. A well drilling apparatus of the kind described, comprising a rotary drill tube with a drill bit seat in its lower end, a drill bit head, a pivotally hung drill bit

for said head, and a laterally adjustable and removable fulcrum block for connecting the drill bit to the drill head, and means for projecting the drill bit into its seat.

5. A well drilling apparatus of the kind described, comprising a rotary drill tube with drill seats in its lower end, a drill head having pivotally connected drill bits, drill bits having in their inner faces tapering grooves adapted to register with each other when the bits are expanded, and a longitudinally disposed tapering stem for expanding the drill bits with a tight fit.

6. A well drilling apparatus of the kind described, comprising a rotary drill tube with drill seats in its lower end, a drill head having pivotally connected drill bits, drill bits having in their inner faces tapering grooves adapted to register with each other when the bits are expanded, and a longitudinally disposed tapering stem for expanding the drill bits with a tight fit, and an adjustable stop connected to the expanding stem to adjust it longitudinally to take up wear.

7. A well drilling apparatus of the kind described, comprising a rotary drill tube, expansible drill bits adapted to be rigidly connected to the drill tube and having on their inner faces longitudinal water courses arranged to register with each other when the drill bits are expanded.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH DARLING.

Witnesses:

E. C. DUFFY,

A. R. STANTOR.