July 12, 1932. R. P. SIMMONS 1,866,943

PERCUSSIVE WELL DRILLING APPARATUS

Original Filed June 29, 1928 3 Sheets-Sheet 1

Fig. 1.

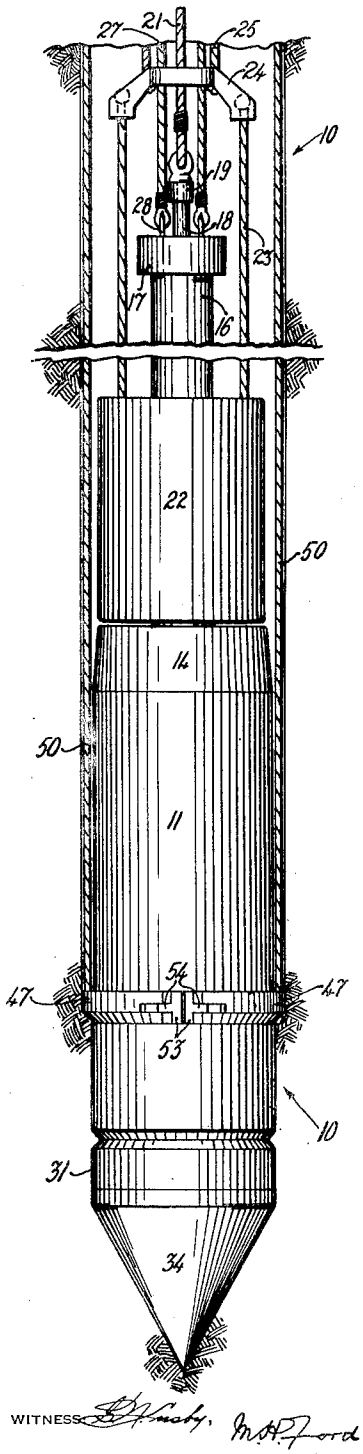
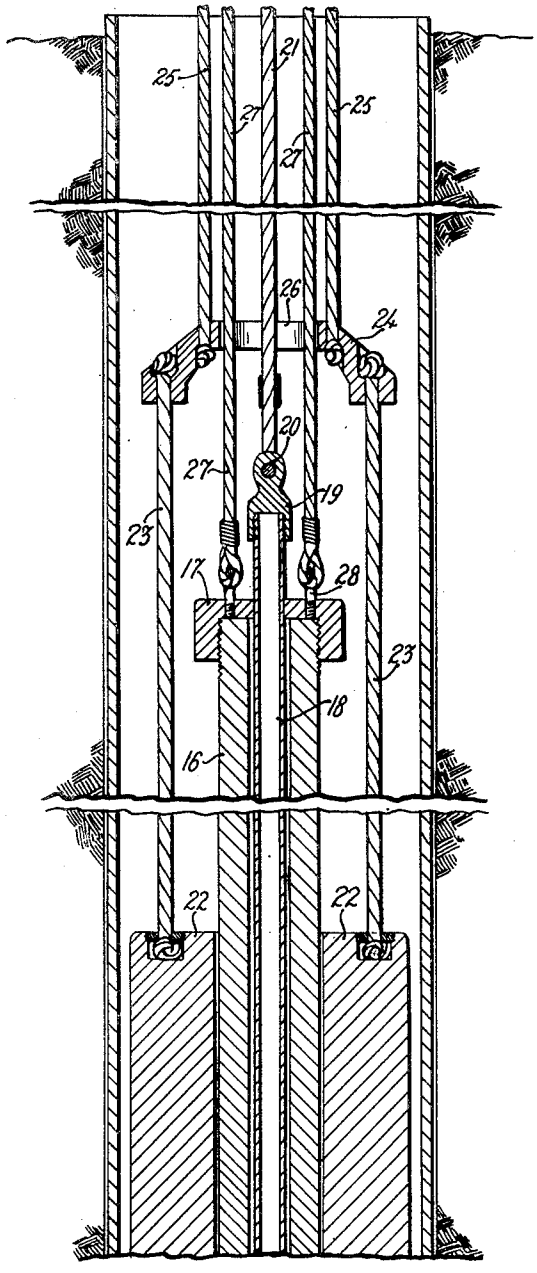


Fig. 2.



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WITNESS: [illegible], M. A. Ford.

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Fig. 3.

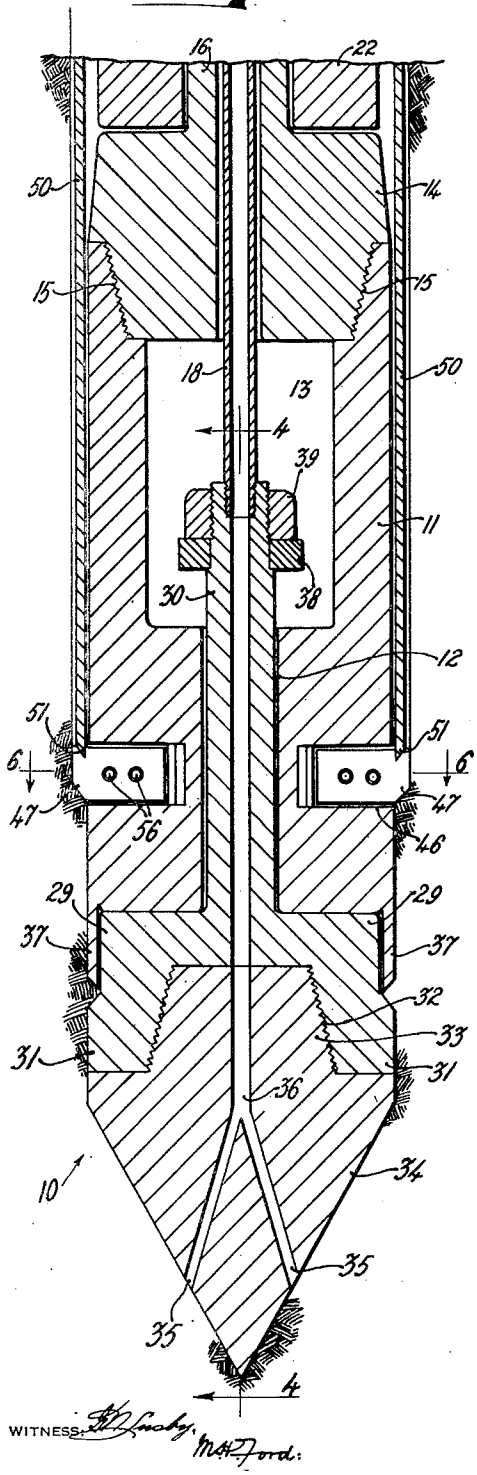


Fig. 5.

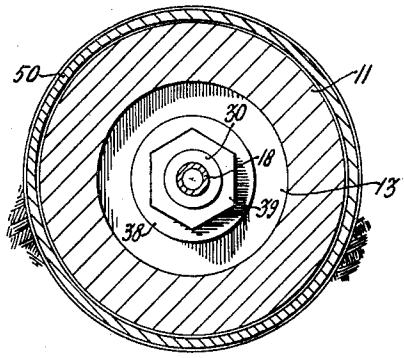
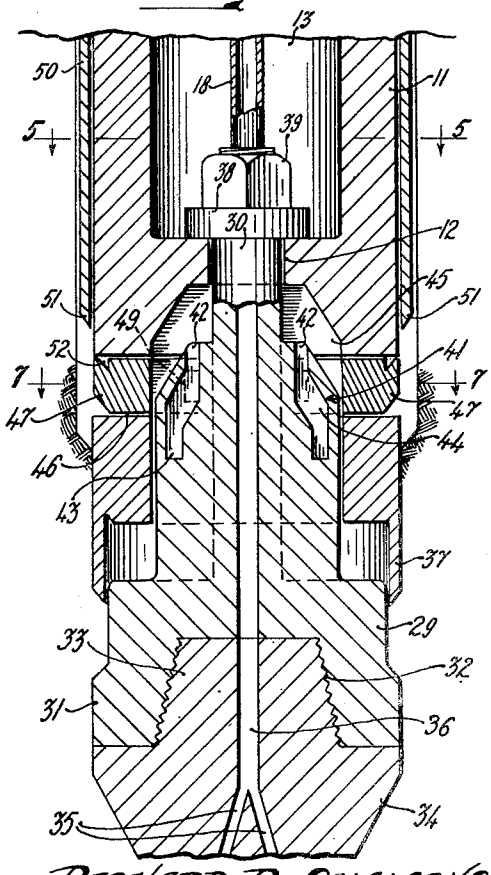


Fig. 4.



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Fig. 6.

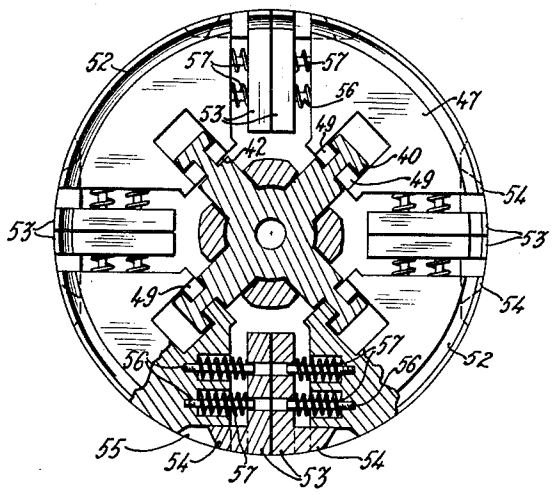


Fig. 7.

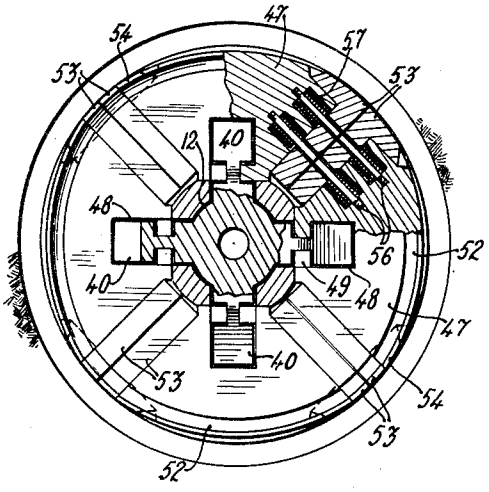
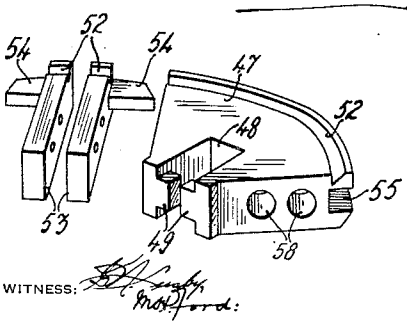
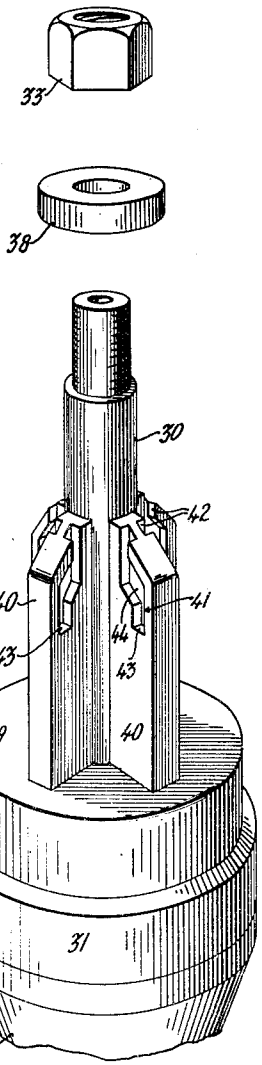


Fig. 9.



WITNESS:

Fig. 8.



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Patented July 12, 1932 1,866,943

UNITED STATES PATENT OFFICE

RICHARD P. SIMMONS, OF NEW YORK, N. Y.

PERCUSSIVE WELL DRILLING APPARATUS

Application filed June 29, 1928, Serial No. 289,271. Renewed February 25, 1931.

This invention relates to improvements in well drilling apparatus in general and more particularly to a percussive gravity drill for drilling oil wells and the like.

The primary object of the invention resides in a shrapnel drill operable by the standard method of drilling, that is, by pounding the drill downwardly through the earth to displace the dirt in the path of movement thereof, which displaced dirt is packed around the walls of the well hole. This method dispenses with the necessity of continuously removing the drilling apparatus from the well hole which is common in rotary drills to remove the drilled residue from the well hole.

Another object is to provide a percussive drill for forming a well hole of a given diameter to accommodate the length of the drill in its downward movement, and which drill embodies auxiliary drill elements for enlarging the diameter of the hole to facilitate the gradual lowering of a follower casing into the well hole during the drilling operation to prevent the accidental cave-in of the walls of the well.

A further object is the provision of a percussive drill having a pointed drill head adapted to be driven downward through the earth by the force of a reciprocating hammer for cutting a plane of a given diameter, while expansible and retractible bits are provided for enlarging the diameter of the hole when expanded for accommodating a follower casing which telescopes the cylindrical body of the drill, but which bits may be retracted to allow the removal of the drill from the well without disturbing the follower casing.

With these and other objects in view, the invention resides in certain novel construction and combination and arrangement of parts, the essential features of which are hereinafter fully described, are particularly pointed out in the appended claims, and are illustrated in the accompanying drawings, in which:—

Figure 1 is a side elevation of my shrapnel drill in position within a well.

Figure 2 is an enlarged vertical sectional view of the upper end of my drill.

Figure 3 is a view similar to Figure 2 but showing the lower end of the drill.

Figure 4 is a detail vertical sectional view on the line 4—4 of Figure 3.

Figure 5 is a horizontal sectional view on the line 5—5 of Figure 4.

Figure 6 is a horizontal sectional view on the line 6—6 of Figure 3.

Figure 7 is a horizontal sectional view on the line 7—7 of Figure 4.

Figure 8 is a detail perspective view of the drill head.

Figure 9 is a detail perspective of one of the expansible bits.

Referring to the drawings by reference characters, the numeral 10 designates my improved shrapnel gravity drill in its entirety which includes a cylindrical body 11 which is provided with central longitudinal bore 12 which opens into an enlarged recess 13 at the top end of the body. The top end of the body is closed by an anvil 14 which is threaded to the body as at 15 for separation therefrom when desired. A reduced tubular shank 16 rises from the anvil and has its top end closed by a screw cap 17. A tube or straight length of pipe 18 is slidably mounted in the tubular shank and extends through the cap 17 to receive a screw cap 19 having an eye 20 to which one end of a suspension cable 21 is attached.

Slidably mounted on the tubular shank 16 is a hammer 22 for striking engagement with the anvil 14 to drive the drill downwardly through the earth. Cables 23 have one end connected to the hammer and their other ends to a yoke 24, which yoke is suspended by cables 25. The yoke has a central opening 26 for the passage of the cable 21 and cables 27 which connect with eyes 28 on the screw cap 17. All of the cables 21, 25 and 27 extend to the surface of the well during drilling thereof.

Slidably mounted within the body 11 is a bit holder 29 which includes a tubular shank 30 slidable in the bore 12 and which has a head 31 underlying the bottom of the body 11, said head having a threaded socket 32 for receiving the threaded stud 33 of a percussive drill bit 34. The drill bit is cone shaped and

has branch ducts 35 which open on the side faces of the bit and converge upwardly to a common duct 36 which registers with the bore in the tubular shank 30. A skirt or flange 37 is provided on the lower end of the cylindrical body to telescope the reduced portion of the head 31 and provides a snug fit between the said parts to prevent dirt from entering the joint therebetween.

The top end of the tubular shank 30 extends into the recess 13 and receives a stop collar 38 held thereon by a nut 39 threaded to the extreme end of the shank. The stop collar serves to limit the downward movement of the drill head and bit with respect to the cylindrical body 11. The lower end of the tube or pipe 18 is threadedly connected to the end of the shank 30 whereby a continuous passage is provided from the branch ducts 35 to the top end of the tube 18 by which dirt will be forced up into the tube during a drilling operation whereby upon withdrawal of the apparatus from the well, an operator may unscrew the cap 19 and take a sample of the material for test purposes. After the sample has been taken, the remainder of the dirt within the continuous passage may be blown out by compressed air or forced out by a ram rod to clean the duct before lowering the apparatus into the well for further operation.

Formed integral with the tubular shank 30 of the bit holder 29 are radially arranged diametrically opposed fins 40 having cam slots 41 in opposite faces thereof. Each cam slot includes an inner vertical slot 42, and outer vertical lower slot 43 and a diagonal wider slot 44 which communicates with the slots 42 and 43. The fins are vertically slidable in recesses 45 in the cylindrical body with which horizontal recesses 46 communicate. Slidably mounted in the recesses 46 are segmental shaped remaining bits 47 having slots 48 therein for the passage of the respective fins 40. Lugs 49 extend from opposite walls of the slots 48 for reception in the respective cam slots. When the reaming bits are extended the cutting edges extend beyond the plane of the side walls of the body as shown in Figure 3 of the drawings to cut a plane for the passage of a follower casing 50 which telescopes the upper portion of the apparatus and has its lower edge bevelled as at 51 for seating in grooves 52 in the projecting top faces of the reaming bits. The weight of the follower casing causes the same to automatically move downward during the well drilling operation. However, when it becomes necessary to retract the bits, the follower casing is slightly raised as shown in Figure 4 to unseat from the grooves 52.

To seal the joints between the reaming bits during expansion and contraction, I provide pairs of blocks 53 therebetween which have tongues 54 for reception in grooves 55 in the outer edge of the bits. Rods 56 pass through the blocks and are threaded into the bits, while expansion springs 57 encircle the rods and bear against the blocks and the bottoms of recesses 58 in which they are housed. The springs act to force the blocks into engagement with each other to effectively seal the joints between the reaming bits during expansion and retraction of the same for preventing dirt from entering the said joints.

In practice, assume that a well hole has been started of a depth sufficient to receive the apparatus 10. In lowering the apparatus into the hole, the cables 21 and 25 remain in a slack condition while the weight of the apparatus is suspended from the taut cables 27 at which time the drill head is in the position shown in Figure 4 of the drawings, wherein the same is in its fullest retracted position within the cylindrical body 11. The reaming bits 47 are in retracted position as the lugs 49 are in the inner slots 42 of the cam slots. When the percussive drill bit 34 strikes the bottom of the well, the cables 27 become slack and the cylindrical body 11 drops down upon the head 31 causing the lugs 49 to enter the outer slots 43 through the diagonal slots 44. This moves the reaming bits to an expanded position whereupon they co-act to provide an annular projecting cutting edge for enlarging the diameter of the well hole to accommodate the lowering of the follower casing 50 therein. For driving the percussive drill downwardly through the earth, the cables 25 are pulled up to lift the hammer 22 a suitable distance above the anvil 14, whereupon the cables are released and the hammer drops by gravity to forcibly strike the anvil, which force is in turn imparted to the cylindrical body and drill. The hammer operation is repeated which drives the percussive drill down to force the dirt in its path in a lateral direction. To remove the apparatus from the well hole, the expanded reamer bits are retracted in a manner already explained, whereupon the cables 27 are pulled up to drag the apparatus through the follower casing. The follower casing serves to retain the shape of the well hole and guide the apparatus in its drilling operations.

While I have described what I deem to be the most desirable embodiment of my invention, it is obvious that many of the details may be varied without in any way departing from the spirit of my invention, and I therefore do not limit myself to the exact details of construction herein set forth nor to anything less than the whole of my invention limited only by the appended claims.

What is claimed as new is:—

1. A well drilling apparatus including a cylindrical body, a conical drill head slidable with respect to said body, reaming bits slidably mounted in said body, suspension cables attached to said body and said drill head, an

anvil on the top of said body, a hammer slidably mounted above said anvil for pounding thereon, means for actuating said reaming bits upon actuation of said drill head with respect to said body and cables attached to said hammer by which the same may be raised and released to drop by gravity upon said anvil.

2. A well drilling apparatus including a cylindrical body, a conical drill head slidable with respect to said body, suspension cables attached to said body and said drill head, an anvil on the top of said body, a hammer slidably mounted above said anvil for pounding thereon, and cables attached to said hammer by which the same may be raised and released to drop by gravity upon said anvil, expansible and retractible reaming bits mounted within said cylindrical body for cutting a plane therebeyond when expanded, and automatic means for controlling the actuation of said reaming bits upon sliding movement of said body and drill head with respect to each other by the manipulation of said first mentioned cables.

3. A well drilling apparatus including a cylindrical body, an anvil fixed on the top of said body, a hammer slidably mounted above said anvil for pounding thereon, a head slidably mounted in said body, a conical drill bit removably supported by said head for drilling a well hole of a given diameter, individual suspension cables for said anvil, hammer, and head, expansible and retractable reaming bits mounted in said body for cutting a plane therebeyond when expanded, and means for actuating said reaming bits upon sliding movement of said cylindrical body and said head with respect to each other.

4. A well drilling apparatus including a cylindrical body, a drill head slidable with respect to said body, suspension cables attached to said body and said drill head respectively, expansible and retractable reaming bits mounted within said cylindrical body for cutting therebeyond when expanded, and automatic means for controlling the actuation of said reaming bits upon sliding movement of said body and drill head with respect to each other by the manipulation of said cables.

5. A percussive drilling apparatus comprising a cylinder, a drill head slidably mounted in the cylinder, radially movable cutting elements mounted in the cylinder for extension beyond the periphery thereof to enlarge the hole being drilled to the diameter of a lining casing, and means for moving said elements inwardly and outwardly, said elements on their upper sides being formed with seats for engagement with a well casing to hold the elements extended and at the same time permit the casing to follow the cylinder in drilling a hole.

6. A percussive drilling apparatus comprising a cylinder, a drill head slidably mounted in the cylinder, radially movable cutting elements mounted in the cylinder for extension beyond the periphery thereof to enlarge the hole being drilled to the diameter of a lining casing, and means for moving said elements inwardly and outwardly, said elements on their upper sides being formed with seats for engagement with a well casing to hold the elements extended and at the same time permit the casing to follow the cylinder in drilling a hole, the head being actuable independently of the cylinder, and an impact member disposed above the cylinder for driving the same and thereby effecting cutting action of said cutting elements when extended.

In testimony whereof I have affixed my signature.

RICHARD P. SIMMONS.