Feb. 28, 1933. H. D. SANDSTONE 1,899,728

WELL DRILLING APPARATUS

Filed Oct. 16, 1931

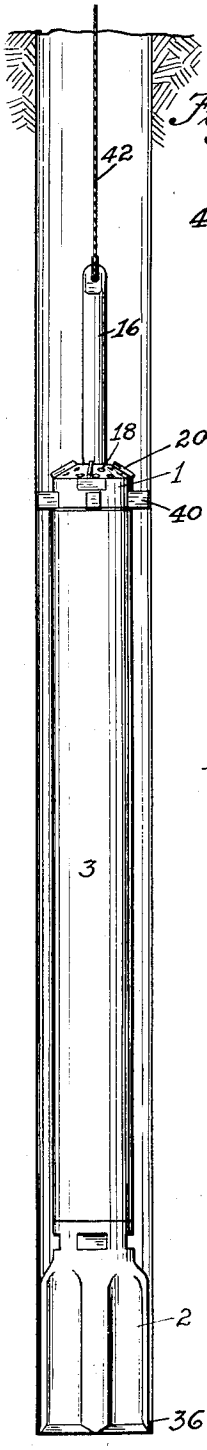


Fig. 1.

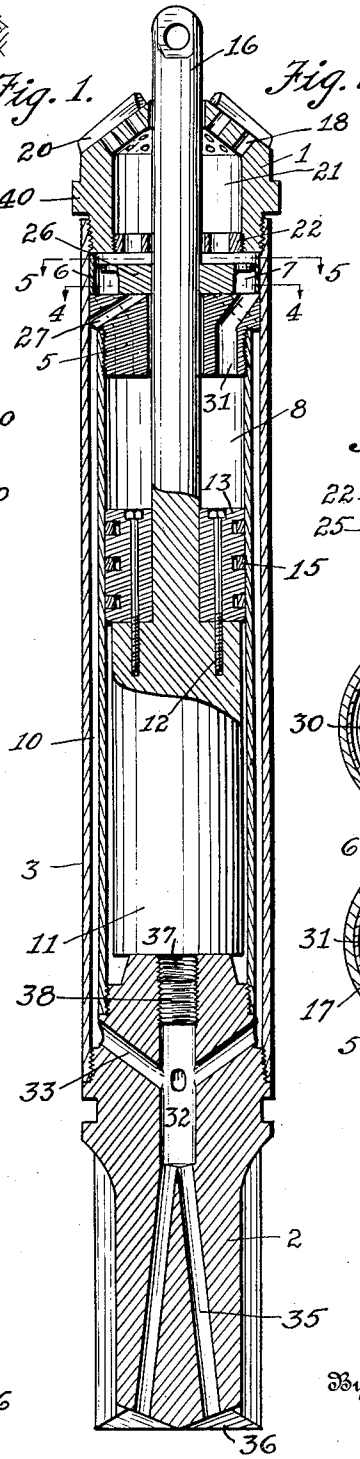


Fig. 2.

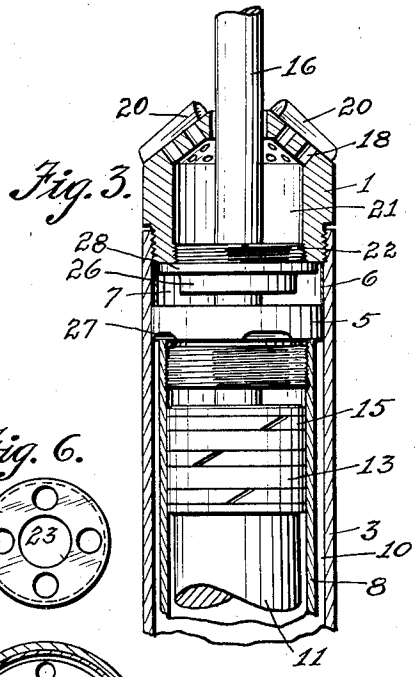


Fig. 3.

Fig. 6.

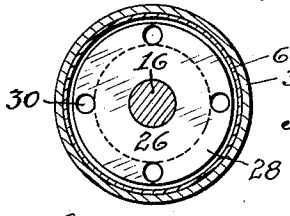


Fig. 5.

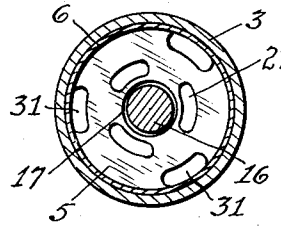


Fig. 4.

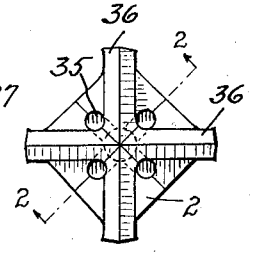


Fig. 7.

Inventor;
HARVEY D. SANDSTONE,
By Horace Barnes,
his Attorney.

Patented Feb. 28, 1933 1,899,728

UNITED STATES PATENT OFFICE

HARVEY D. SANDSTONE, OF PORTLAND, OREGON

WELL DRILLING APPARATUS

Application filed October 16, 1931. Serial No. 569,275.

This invention relates to apparatus for boring relatively deep wells, such as oil-wells; and has for its principal object the provision of a chambered drill-body of simple and practicable construction, including a hammer actuated mechanically through a cable extending from the surface of the ground to lift and drop upon the drill-head.

A further object of the invention is the provision of means in combination with a reciprocative hammer and incorporated within the drill-body to propel a jet of water through passages in the drill-head in the intervals between each blow of the hammer whereby the cutting-edges of the drill may be freed from detritus and cooled.

Other objects and advantages residing in my invention, and objects relating to details and arrangements of parts thereof, will be readily apparent in the course of the detailed description to follow.

The accompanying drawing illustrates by way of example a representative form of my invention, in which:

Figure 1 is a view in side elevation of a drilling tool embodying my invention, shown in operative condition in a well-bore.

Fig. 2 is a view in vertical section of the drilling tool.

Fig. 3 is a fragmentary view of the same, principally in vertical section, illustrating the upper portion of the apparatus in a different position to that shown in Fig. 2.

Fig. 4 is a view in cross-section on line 4—4 of Fig. 2.

Fig. 5 is a view in cross-section on line 5—5 of Fig. 2.

Fig. 6 is a detached plan view of an element of the invention.

Fig. 7 is a bottom plan view of the drill-head.

Referring to said views, the reference numeral 1 indicates the cap of my improved drill-body and 2 the drill-head at the lower extremity of the body. Said cap and head are each externally screw-threaded to receive the opposite ends of an outer cylindrical casing-shell 3. Closely fitting within the upper end of the casing-shell is a valve-base 5 between whose upper end and the cap is positioned a spacer-ring 6 providing a valve-chamber 7 interiorly thereof. The lower portion of the valve-base is reduced in its diameter and screw-threaded to receive the upper end of a cylinder 8 and which is similarly connected at its lower end to a reduced portion of the drill-head 2. The casing-shell 3 and cylinder 8 are disposed in concentric relation to provide an annular space 10 therebetween.

A hammer 11 of considerable weight is mounted within the bore of the cylinder 8 for reciprocative movements and secured thereto at its upper end, as by bolts 12, is a piston 13 provided with packing-rings 15 of the expansion type making leakproof engagement with the interior wall of the cylinder. A hammer-stem 16 extends axially upward from said hammer and passes freely through an axially disposed passage 17 in the valve-base 5.

The cap 1 is formed with a conical upper extremity whose apex is formed with a passage through which the stem 16 extends, and is formed with a plurality of apertures 18 surrounding said passage. Upon the exterior surface of said conical portion of the cap upwardly protruding cutting-bits 20 are formed to provide convenient means for extricating the tool from the well in the event of a cave-in, as will be particularly explained hereinafter.

A chamber 21 is formed interiorly of said cap which is partially closed at its lower end by a disk 22, see Fig. 6. Said disk is exteriorly screw-threaded and is thus retained within the lower end of the cap and is provided with a central passage 23 to admit of the extension therethrough of the hammer-stem 16. The disk is further formed with a plurality of apertures 25 spaced about its central passage.

A valve-member is disposed within the valve-chamber 7 consisting in a body 26 of circular configuration arranged to close the apertures 25 in its upward limit of travel and when seated upon the valve-base 5 to close the ports 27 extending through the valve-base connecting the chamber 7 with the annular space 10. A peripheral flange 28 is

formed upon the upper portion of the valve-member and is provided with a plurality of apertures 30. Said member is provided with a central passage through which the hammer-stem 16 slidably extends but is fitted thereto with somewhat closer engagement than the other passages through which the stem is extended.

The valve-base 5 is formed with a plurality of ducts 31 connecting the bore of the cylinder 8 with the chamber 7, the upper limits of said ducts being disposed exteriorly of the valve-body 26 so as not to be covered thereby.

The drill-head 2 is formed with an axially disposed bore 32 in its upper portion into which a plurality of branches 33 extend leading from the annular space 10, and therebelow the bore 32 is divided into a number of branches 35 having outlets, respectively, between the several cutting-bits 36 formed upon the cutting-face of the drill-head. The upper portion of the bore 32 is screw-threaded, as at 37, wherein a check-valve, indicated at 38, is inserted above the branches 33 admitting of the movement of liquid from the bore of the cylinder 8 in one direction only.

The cap 1 is formed with a plurality of radially extending lugs 40 engageable with the inner surface of the well-casing 41 to aid in maintaining the alignment of the tool.

In operation, the well-bore is supplied with water so that the tool is submerged at least to the extent that the cap 1 is covered. The hammer is lifted by the cable 42 through suitable and well-known actuating machinery, not shown, upon the surface of the ground and dropped to strike with all of the force of its gravity upon the drill-head 2 and thus by repeated blows to drive the drill through the rock or other subterranean formations.

Upon each downward stroke of the hammer the interior conditions of the apparatus will appear substantially as represented in Fig. 2, wherein the valve-body 26 is seated upon the valve-base 5 to close the ports 27 whereupon water is drawn into the cylinder-bore by the suction induced by the close-fitting piston 13, the course of water being through the cap-apertures 18, the chamber 21, the apertures 25, about the flange 28 and apertures 30 of the valve-member, and finally, through the ducts 31 of the valve-base.

On each upward stroke of the hammer-piston the water in the cylinder-bore is forced upward in sufficient volume through the ducts 31 to lift the valve-member and thus close the apertures 25 in the disk 22 whereupon the water will be forced through the chamber 7 and downwardly through the ports 27 into the annular space 10 and thence through branches 33 to the bore 32, and finally, through the branches 35 to be evacuated at their outlets in proximity of the cutting-bits 36.

Thus at each complete cycle of operations and stroke of the hammer upon the drill water is pumped in and out of the drill apparatus having intake at its upper portion where the exterior water is comparatively free from suspended matter and exhausting in close relation to the cutting-bits, thus washing the rock-surface of pulverized or broken material and greatly facilitating the cutting operations of the drill.

In its drilling operations the hammer is lifted at each stroke to within a short distance at its upper end from the bottom of the valve-base, 5, as seen in Fig. 3, and in falling freely upon the drill-head from a considerable distance and with relatively great weight will readily penetrate the substratas.

Provision is made for withdrawing the drill-apparatus from the well-bore by drawing upwardly upon the cable 42 which will cause the hammer to engage the valve-base and thus lift the apparatus through the well-bore. In the event that a cave-in or other obstruction above the cap 1 is met the cable may be alternately lowered and jerked upward to cause the hammer to strike against the valve-base repeatedly whereupon the cap 1 will serve as a spear-head to penetrate the obstacle under the upward blows of the hammer aided by the cutting-bits 20 formed thereon. The ring 6 interposed between the cap and the valve-base 5 serves to support the valve-base in receiving the upward blows of the hammer without injury to its threaded connection with the cylinder 8.

Having described my invention, what I claim is:

1. Drilling apparatus, consisting of a drill-head having a drilling-face and water-passages therethrough with their outlets in said drill-face, concentric cylinders connected to said drill-head having an annular space therebetween whereby water may circulate to communicate with the passages in said drill-head, a hammer mounted in the bore of said inner cylinder including a piston, a valve device including ducts leading from the cylinder bore and to said annular space, and means to actuate said hammer to lift and drop upon said drill-head and to pump water through said ducts, space, and passages to the drilling-face of the drill-head.

2. Drilling apparatus, consisting of a drill-head having a cutting-face and water-passages therethrough having their outlets in said cutting-face, a cylindrical casing connected to said drill-head, a cap covering the upper end of said casing, a valve-base mounted in said casing, a cylinder connected at its opposite ends to said valve-base and to said drill-head whereby an annular water-space is provided communicating with the passages of said drill-head, a hammer mounted in said

cylinder including a piston and adapted to be lifted and dropped upon said drill-head, said cap being formed with apertures whereby water may enter the valve-chamber above said valve-base from the exterior of the apparatus, said valve-base having ports connecting said annular space with said valve-chamber and ducts connecting the interior of said cylinder with said valve-chamber, means to lift and drop said hammer, and a valve-member adapted to close the intake of water through said cap and the flow of water through said ports into said space at the respective lift and fall of said hammer-piston.

3. Drilling apparatus, consisting of a drill-head having a water-passage therethrough, a casing connected to the upper end of said drill-head, a hammer mounted in said casing, means for lifting and dropping said hammer upon the drill-head, communicative connections between the interior of said casing above said hammer and said water-passage, and means actuated by the lift and fall of said hammer whereby water may be pumped through said connections and water-passages to the cutting-face of the drill-head.

4. Drilling apparatus, consisting of a drill-head having a water-passage therethrough, a casing connected to the upper end of said drill-head, a hammer mounted in said casing, means for lifting and dropping said hammer upon the drill-head, communicative connections between the interior of said casing above said hammer and said water-passage, means actuated by the lift and fall of said hammer whereby water may be pumped through said connections and water passage to the cutting-face of the drill-head, and a bore connecting the interior of said casing below said hammer with said water-passage including a check-valve.

5. Drilling apparatus, consisting of a drill-head terminating in a drilling-face and having a water-passage therethrough, a casing above said drill-head having inlets for water at its upper end, a hammer mounted in a cylindrical chamber of the casing below said inlets, said casing being formed with a water-channel in its walls communicatively connecting the casing-chamber above said hammer with said water-passage, and means to actuate said hammer to lift and drop upon said drill-head and to induce the flow of water from above the hammer through said water-channel and passage to the drilling-face of the drill-head.

6. Drilling apparatus, consisting of a drill-head terminating in a drilling-face and having a water-passage therethrough, a casing connected above said drill-head formed with a cylindrical chamber and a water-channel in its walls communicatively connecting said chamber with said water-passage, a hammer mounted in said casing-chamber and provided with a piston, a valve device including ducts leading from said chamber to said water-channel, and means to actuate said hammer to lift and drop upon said drill-head and to pump water through said ducts, water-channel and passage to the drilling-face of the drill-head.

7. Drilling apparatus, consisting of a drill-head terminating in a drilling-face and having a water-passage therethrough, a casing connected above said drill-head formed with a hammer-chamber and a water-channel in its walls communicatively connecting said chamber with said water-passage, a hammer mounted in said chamber and provided with a piston, a valve device including ducts leading from said chamber to said water-channel, means to lift and drop said hammer upon said drill-head and to pump water through said ducts, channel and passage to the drilling-face of the drill-head, and a bore connecting said chamber with said passage including a check-valve.

HARVEY D. SANDSTONE.