L. S. GARDNER.

ROTARY DRILL.

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1,238,757.

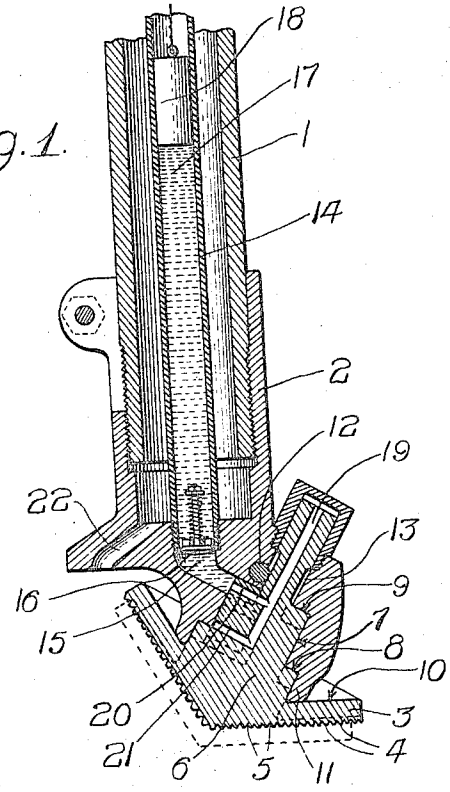


Fig. 1.

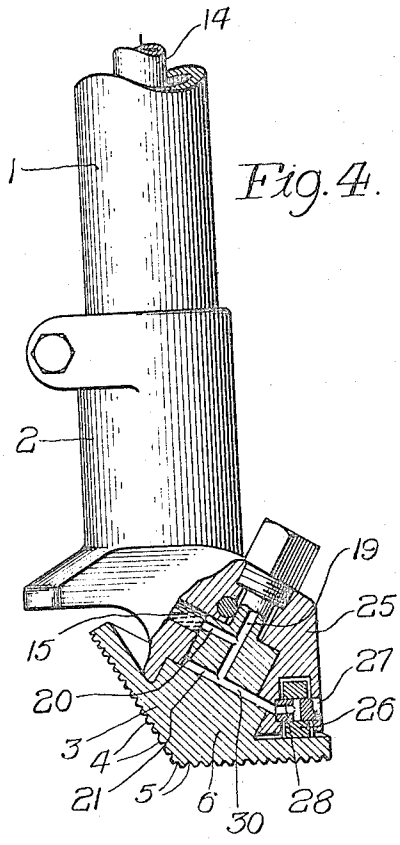
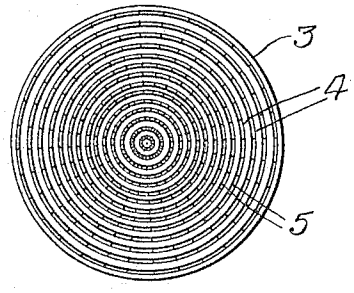
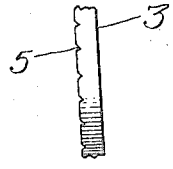


Fig. 4.

Fig. 2.

Fig. 3.





Witnesses:

Harry S. Gaither

Ruth E. Zettervall

Inventor

Levi S. Gardner

by Chamberlin & Vendenreich

Attys.

UNITED STATES PATENT OFFICE.

LEVI S. GARDNER, OF CEDAR GROVE, LOUISIANA.

ROTARY DRILL.

1,238,757. Specification of Letters Patent. Patented Sept. 4, 1917.

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To all whom it may concern:

Be it known that I, LEVI S. GARDNER, a citizen of the United States, residing at Cedar Grove, parish of Caddo, State of Louisiana, have invented a certain new and useful Improvement in Rotary Drills, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to drills for boring holes through earth and rock, wherein there is a rotary bit which removes the material at the bottom of the hole a little at a time.

One of the objects of the invention is to produce a novel construction and arrangement which will permit the use of a simpler, larger and more powerful bit than it has heretofore been possible to employ.

A further object of my invention is to produce a drill of the character described in which the thrust on the bit is most effectively applied.

A further object of the present invention is to produce a construction and arrangement which will permit the drill to be inserted in a hole smaller in diameter than that which is bored by the drill.

A further object of the present invention is to produce a simple and efficient lubricating system for lubricating the bearing surfaces between the bit and the stock.

A further object of the present invention is to simplify and improve the structural details of drills of the character specified, so as to make them more efficient and simple and convenient in adjustment and operation.

The various features of novelty whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of my invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawing, wherein:

Figure 1 is a vertical central section through a drill arranged in accordance with one form of my invention, the bit being shown in full lines in its working position and in dotted lines in the position which it occupies when out of contact with a surface to be worked upon;

Fig. 2 is a face view of the bit;

Fig. 3 is an edge view of a fragment of the bit; and

Fig. 4 is a view partly in side elevation and partly in central longitudinal section, showing a slight modification.

Referring to the drawings, 1 represents a tubular drill stock on the lower end of which is carried a single bit. In the arrangement shown in Fig. 1 the bit is carried by a head, 2, screw threaded or otherwise detachably connected upon the lower end of the tubular stock. The bit comprises a conical member, 3, having its face scored or grooved along circular lines, 4, extending around the same and along lines, 5, following elements of the conical surface from the apex to the base. On the rear side of the cone is a stem, 6, coaxial with the cone. In the head of the drill is a cylindrical opening, 7, arranged at an angle to the horizontal equal to one-half the angle of the cone, so that when the stem of the bit is placed in the head, the lowermost element of the cone, that is the lowermost line extending from the apex to the base, lies horizontally. The parts are so proportioned that when the bit is in its working position the apex is just at the longitudinal axis of the drill. With this arrangement, when the bit rests upon a surface to be bored or drilled, and the drill is turned, the bit will have a true rolling motion on the surface, always engaging with the surface along a single line, only, so that the entire weight of the drill or pressure on the drill comes at all times on a series of points distributed in a row from the apex of the conical face of the bit to the base; and therefore as the bit rolls over the material which is being worked upon, the surface is progressively disintegrated by the pricking action of the points or teeth on the bit.

The bit is preferably so mounted that when free to do so it drops down from the position shown in full lines in Fig. 1 to that shown in dotted lines, with the result that the extreme outer point of the bit is carried in toward the axis of the drill, thus giving a clearance at the side of the hole when the drill is being placed in position or removed. In other words, the drill can readily be inserted into or removed from a hole of the diameter which it is adapted to produce, or it can be inserted in a hole of a still smaller diameter.

The arrangement for transmitting the

thrust from the stock or the head to the drill may be varied. In the arrangement shown in Fig. 1, the stem has a step formation, that is the section next to the bit is larger than the following section so as to provide an annular shoulder, 8, lying in a plane at right angles to the axis of the stem. The third section of the stem is smaller in diameter than the second section so that a second annular shoulder, 9, is produced. The bore 7 in the head is correspondingly stepped, thus producing a simple and effective thrust bearing. I prefer to make that portion of the conical portion of the bit which lies outside of the stem of uniform thickness, thus providing a horizontal line, 10, on the upper side just above the line of teeth or points on the under side which is in engagement with the surface to be drilled. Then by extending the head down in contact with the upper or rear side of the body portion of the bit, as indicated at 11, a direct downward thrust is produced on the bit directly above the line or row of teeth or points which are in action at any given instant. The bit may conveniently be prevented from dropping entirely out of the head by means of a pin, 12, passing through the head and engaging with a reduced portion or neck, 13, on the stem of the bit. This arrangement permits the bit to move in the direction of its axis within the limits determined by the length of the reduced neck.

It is usually desirable to lubricate the bearings for bits in drills of this type. In the arrangement shown, provision is made for lubricating the bearing surfaces in such a way that the axial movement of the bit is given the added function of associating in the lubrication. Referring to Fig. 1, 14 is an oil tube or container of any desired length secured at its lower end to the head so as to communicate with a passage, 15, leading into the bore 7 in which the stem of the bit lies. In the lower end of the oil tube is a downwardly-opening check valve, 16. Resting on the oil 17 in the tube is a suitable weight, 18, which exerts a constant downward pressure on the oil and keeps the passage 15 full. In the stem of the bit is an axial passage, 19, which preferably opens out of the upper end of the stem. From the passage 19 extend two lateral branches, 20 and 21, the branch 20 being normally in open communication with the passage 15 and the branch 21 opening out at the side of the stem just above the annular shoulder 8. The passage 15 opens into the bore 7 approximately in the plane of the annular shoulder 9 on the stem. Normally, when the drill is in operation, the passage 19 with its branches 20 and 21 are full of oil. At suitable intervals, for example, every half hour, the drill is lifted slightly so as to allow the bit to drop. This permits oil to flow directly from the passage 15 upon the annular shoulder 9 and from the branch passage 21 in the stem to the shoulder 8, causing both of these shoulders to be covered with a layer of oil. When the drill is again lowered, the bit returns to its working position with all of its bearing surfaces thoroughly lubricated. By extending the passage 19 to the upper end of the stem of the bit there is always a supply of lubricant in position to flow down around the cylindrical bearing surfaces whenever opportunity is given. The check valve serves to prevent water from passing up around the stem of the bit into the container for the lubricant.

The head of the drill has a suitable bore or channel, 22, for the passage of water, as is usual in drills of this kind.

In Fig. 4 the construction is slightly modified. In this arrangement the head 25 of the drill has a small roller, 26, which engages with the upper side of the bit along a line lying directly above and parallel with the line or row of teeth or points which are in any given instant picking their way into the surface which is being operated upon. The roller may be mounted on a suitable shaft, 27, having a passageway, 28, leading from the inner end to one side at a point between the axial length of the roller; the stem of the bit being provided with a third branch passage, 30, which communicates with the passage 28 and allows oil to flow freely into the bearing for the roller.

It will thus be seen that, by using only a single bit, it may be made in the form of a cone having an obtuse angle, since the idle portion is free to extend across the axis of the drill. This permits the bit to be made heavier and more powerful than where a plurality of bits are used, makes it easier to bring the apex of the bit to the axis of the drill, simplifies and improves the mounting of the bit and the distribution of the pressure and, by giving a comparatively large diameter to the base, keeps the speed of rotation about its own axis low and simplifies the problem of lubrication and wear.

While I have illustrated and described with particularity only two preferred forms of my invention, I do not desire to be limited to the exact structural details thus illustrated and described; but intend to cover all forms and arrangements which fall within the terms employed in the definitions of my invention constituting the appended claims.

I claim:

1. In a device of the character described, a stock, a bit in the form of a cone whose angle is greater than a right angle and whose face is roughened, and means for revolubly mounting the bit on the stock so as to bring

one of the elements of the cone horizontal and radial to the axis of the stock, said means being constructed and arranged to permit the bit to move bodily a limited distance in the direction of its own axis.

2. In a device of the character described, a stock, a bit in the form of a cone having a roughened surface, means for revolubly mounting the bit on the stock so as to bring one of the elements of the cone horizontal and radial to the axis of the stock, the base of the bit being hollowed out in the shape of a frustum of a cone having its elements parallel with the face of the bit, and a bearing post on the stock engaging with the element of the inner conical surface lying directly above the aforesaid horizontal cone element.

3. In a device of the character described, a stock, a bit in the form of a cone having a roughened surface, means for revolubly mounting the bit on the stock so as to bring one of the elements of the cone horizontal and radial to the axis of the stock, the base of the bit being hollowed out in the shape of a frustum of a cone having its elements parallel with those of the conical face of the bit, and a rolling bearing member between the stock and the element of the inner conical surface which is horizontal and radial to the axis of the stock.

4. In a device of the character described, a stock, a bit in the form of a cone having a roughened face, and means for mounting the bit on the stock so as to make it revoluble about its own axis arranged at an angle with the horizontal equal to the angle between it and an element of the cone and permit a limited bodily axial movement of the bit from a working position to an idle position in which it lies nearer the axis of the stock than in said working position.

5. In a device of the character described, a stock, a bit in the form of a cone having a roughened surface, a stem at the axis of the bit, a diagonal bearing in the stock for receiving the stem and revolubly supporting the bit in a position in which one of the elements of its surface lies horizontal, said stem and said bearing having engaging shoulders arranged at right angles to the axis of the bit, and means for affording the bit a limited axial movement to bring said shoulders out of engagement with each other.

6. In a device of the character described, a stock, a bit in the form of a cone having a roughened surface, a stem at the axis of the bit, a diagonal bearing in the stock for receiving the stem and revolubly supporting the bit in a position in which one of the elements of its surface lies horizontal, said stem and said bearing having engaging shoulders arranged at right angles to the axis of the bit, means for affording the bit a limited axial movement to bring said shoulders out of engagement with each other, and means for automatically introducing a lubricant between said shoulders when they are separated from each other.

7. In a device of the character described, a stock, a bit in the form of a cone having a roughened face, and means for revolubly mounting the bit on the stock so as to bring one of the elements of the cone horizontal and radial to the axis of the stock, said means being constructed and arranged to permit the bit to move bodily a limited distance in the direction of its own axis.

In testimony whereof, I sign this specification in the presence of two witnesses.

LEVI S. GARDNER.

Witnesses:
B. Ross Jones,
George Thurber.