A. GERDES.

ROCK DRILL.

APPLICATION FILED JULY 31, 1913.

1,200,935.

Patented Oct. 10, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

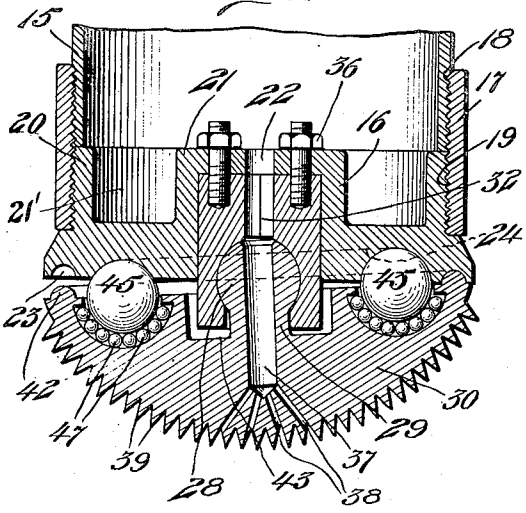


Fig. 2.

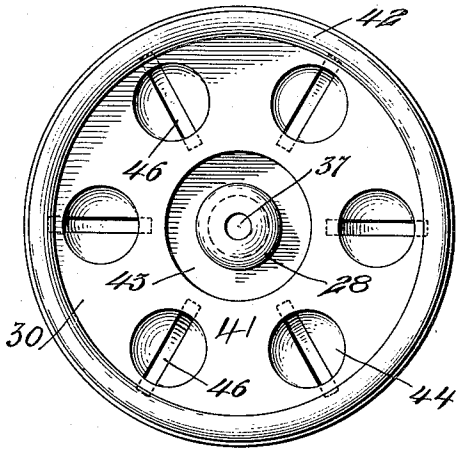


Fig. 3.

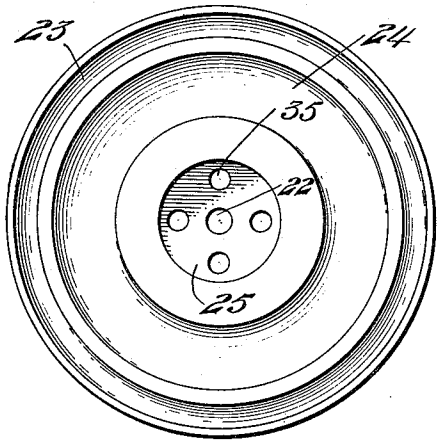


Fig. 4.

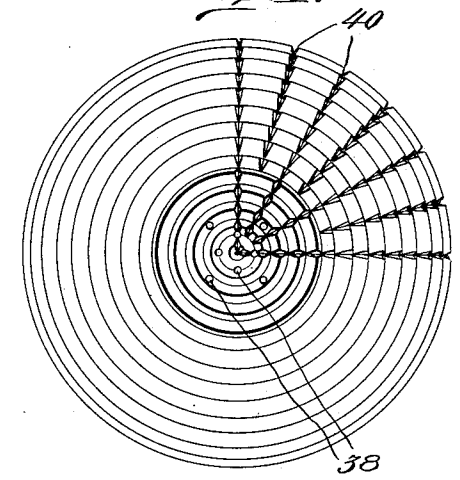
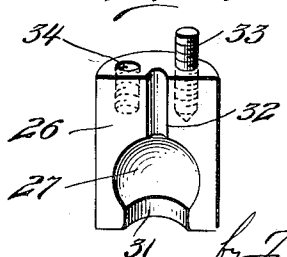


Fig. 5.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 6.

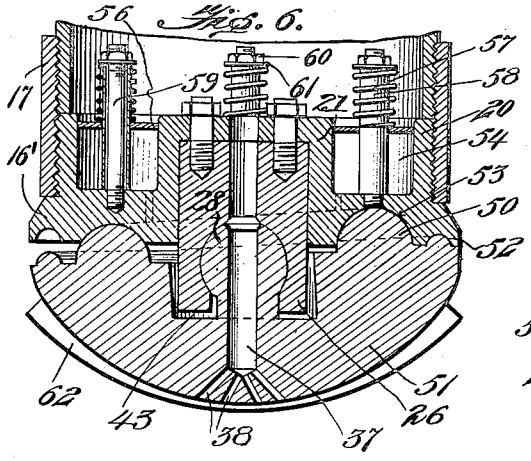


Fig. 7.

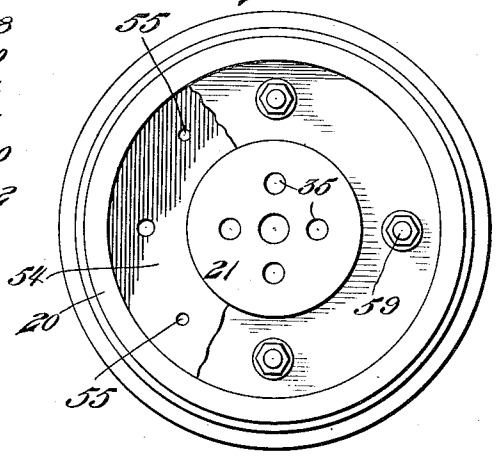


Fig. 8.

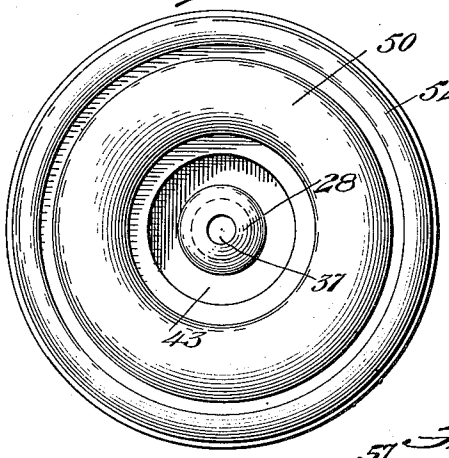


Fig. 9.

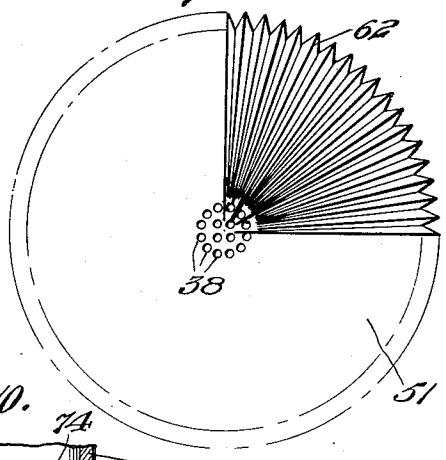
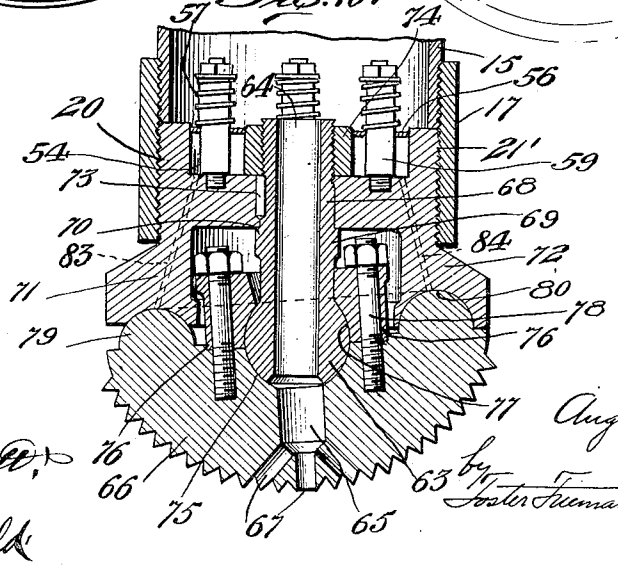


Fig. 10.



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UNITED STATES PATENT OFFICE.

AUGUST GERDES, OF GRETNA, LOUISIANA.

ROCK-DRILL.

1,200,935. Specification of Letters Patent. Patented Oct. 10, 1916.

Application filed July 31, 1913. Serial No. 782,267.

To all whom it may concern:

Be it known that I, AUGUST GERDES, a subject of the Emperor of Germany, residing at Gretna, Jefferson parish, State of Louisiana, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification.

This invention relates to rock drills and has particular reference to a drill which is adapted for use in boring oil and Artesian wells and the like, but it will be understood that certain features of the same are adapted for use in rock drills generally.

The object of the invention is to generally improve this form of drills and provide a connection between the drill or bit and the drill head by means of which a wabbling motion as well as a rotary motion can be given to the drill. Such a motion is preferable when boring rock or other hard substances because when the drill strikes an obstacle it will not break or injure any part of the drill but will immediately begin to wabble and wear away the obstacle in this manner. The material loosened by the bit on the drill head is then flowed out of the well by water which is pumped in through the body of the drill.

Further objects and the novel features of the invention will be apparent from the following description taken in connection with the drawings, in which:

Figure 1 is a vertical sectional view of so much of the drill and drill-head connected thereto as is necessary to show my invention. Fig. 2 is a plan view of the top side of the bit or drill. Fig. 3 is a bottom plan view of the drill head with parts removed. Fig. 4 is a bottom plan view of the bit or drill. Fig. 5 is a perspective view of one-half of a clamp for connecting the bit or drill to the drill-head. Fig. 6 is a vertical sectional view, showing another drill and drill-head embodying my invention. Fig. 7 is a top plan view of the drill head, parts being broken away. Fig. 8 is a top plan view of the drill shown in Fig. 6. Fig. 9 is a bottom plan view of the drill shown in Fig. 6, parts being omitted. Fig. 10 is a vertical section showing still another embodiment of my invention.

Referring to Figs. 1 to 5 of the drawings 15 designates the lower end of a tubular rod to which the drill head 16 is connected by means of the internally threaded sleeve 17, which engages threads 18 on the lower end of the tubular member 15 and threads 19 on the flange 20 of the drill head. The drill head is a circular metal casting and has a central boss 21 formed on its upper side which boss has a passageway 22 at the center thereof and extending through the casting from one face to the face opposite. The opposite face of the head 16 is provided with two concentric grooves 23 and 24. A channel 21′ formed between the flange 20 and boss 21 may constitute a lubricant container, passageways such as the passageways 55 of Fig. 7 may be drilled to connect the groove 24 and channel 21′ so as to supply the lubricant to the bearing surface, the channel 21′ being closed at the top by a suitable cover in the same manner as the lubricant containing channel in Figs. 6 and 7. The groove 23 is near the edge of the bottom face of the head and the groove 24 is within the groove 23 and is deeper at one side and shallower at the opposite side as indicated in Fig. 1 so that the depth of the groove varies between the shallower and deeper parts thereof. The plane of the groove 24 is therefore inclined to the axis of the drill head, the pipe 15 and the hole which is drilled. At the center of the bottom face of the head 16 and corresponding to the boss 21 there is a cylindrical cavity 25 of a size to receive the two similar clamping halves 26, which are recessed at 27 to form a socket which receives the ball or head 28 connected by the neck 29 to the casting comprising the drill or bit 30, the neck 29 extending through the narrow part 31 of the clamping member 26. Each of the halves constituting the clamping member has a channel 32 and together the channels 32 form a conduit which registers with the aperture 22 in the boss 21. When the bit or drill 30 is assembled on the drill-head 16 the two halves are fitted around the ball 28 which engages in the socket 27 and by means of pairs of bolts 33 on the two halves 26, the bit is secured to the drill-head. The bolts 33 are threaded at their opposite ends to fit in threaded holes 34 in the halves and when passed through the holes 35 in the boss 21 they receive the nuts 36 and are thereby rigidly connected to the drill-head.

There is a passageway 37 which extends through the ball 28 and part of the drill or cutter 30 and terminates between the teeth in the bottom convex face of the drill in a plurality of separate smaller outlets 38.

It will thus be seen that water pumped through the tubular part 15 from the top of the well or upper end of the drill will pass through the opening 22, channels 32 and 37 and out of the small openings 38 into the bottom of the well from whence it will flow up the sides of the drill and wash the loose sand and dirt out of the well. The bearing between the ball and socket will also be lubricated by any leakage of water and need not necessarily be packed, though packing may be supplied if desired.

The spherical face of the drill or bit 30 may have any suitable cutting or grinding elements thereon, but I prefer to provide the same with a series of concentrically arranged teeth 39 which may extend over the entire bottom face of the drill and be beveled to suit and each of the parallel teeth may be formed into a series of separate teeth by cutting radial grooves 40 in the face of the drill, as is shown in the upper right hand part of Fig. 4. It is to be understood that this arrangement may be continued throughout the entire face if desired.

The top face 41 of the drill or bit 30 has an annular peripheral ridge 42 at its outer edge which corresponds to the groove 23 in the abutting face of the head 16, the ridge 42 being adapted to move into the said groove 23 as the drill head is rotated and operated. At the center of the face 41 and surrounding the neck of the ball 28 there is a cavity 43 to receive the lower ends of the halves forming the clamping member which engages the head 28. Between the cavity 43 and the ridge 42 there is a series of pockets 44, six in number in the present instance, which hold the large spherical steel balls 45, the bottoms of the pockets being formed with radial recesses or races 46 for the small steel ball bearings 47. As the drill head is rotated the bit or drill 30 may move with with the head if clamped tightly enough or a wabbling motion may be imparted to the drill, depending on the material operated upon and the obstructions encountered. It will be apparent that a wabbling motion will be given to the drill 30 by the head on account of the fact that the groove 24 in the head is inclined to the axis of the drill-head and the well drilled, the balls being retained in their pockets but rotation of the balls in any direction is permitted as the head is rotated.

In Figs. 6 to 9 inclusive I have shown a slight modification, in which form the balls 44 are replaced by an annular ridge 50 which is cast integral with the top face of the drill or bit 51 and within the ridge 52, which latter corresponds to the ridge 42 in Figs. 1 and 2. The ridge 50 is of the same height throughout and of a shape to fit the groove 53 in the bottom face of the head 16', the groove 53 corresponding to the groove 24 in the head shown in Figs. 1 and 3. In order to provide for proper lubrication of the groove 53 which forms a bearing for the ridge 50 which slides therein, the annular channel 54 formed between the boss 21 and the flange 20 is utilized as a grease cup having a series of passageways 55 in its bottom which open into the groove 53. The grease cup is closed by means of an annular plate 56 which fits into the channel 54 and pressure is exerted against the top of the same by means of a series of springs 57 encircling the guide sleeves 58. The guide sleeves 58 surround the bolts 59 which are screwed into the drill head 16' and nuts 60 and washers 61 at the upper ends thereof form bearings for the outer ends of the springs 57 while the inner ends of the springs bear against the plate 56 and tend to compress the grease in the cup 54, and force it through the passageways 55 to the bearing surfaces.

The bottom face of the bit or drill 51 has a series of radially extending angular teeth 62. So many as are necessary to show the construction of the same are shown in the upper right hand part of Fig. 9, but it is to be understood that the same extend throughout the spherical bottom face of the drill 51. The drills 30 and 51 are interchangeable as the former may clearly be attached to the head 16' while the latter may be connected to the head 16, if desired. Furthermore, the spherical bits may each be provided with teeth of both kinds described. In other respects the construction of the drill shown in Figs. 6 to 9 is substantially the same as that shown in Figs. 1 to 5 inclusive. It will be understood that the clamping members for connecting the drill to the head may be applied in the same manner as shown in Figs. 1 to 5 inclusive.

It will be perfectly obvious that the ball and socket connection between the drill and drillhead may be reversed from the form shown in Figs. 1 and 6 and a simpler and more durable form such as shown in Fig. 10 may be substituted therefor, substantially the same wabbling connection and function being obtained. In the construction shown in Fig. 10 the guiding groove and ridge corresponding to the groove 43 and ridge 42 in Fig. 1 have been omitted, but may be supplied if desired. The tubular member having the enlargement or ball 63 at its end, has a longitudinal bore 64 which extends the entire length of the same and establishes communication between the interior of the tube 15 and the channel 65 which terminates in the face of the bit 66 in a series of smaller openings 67. The shank 68 of the ball member 63 has an enlarged part 69 thereon which forms a shoulder 70 which abuts against the bottom of the cavity 71 in the drill-head 72. The shank of the tubular member extends

through a central opening in the drill-head 72 and is prevented from turning therein by means of the key 73. The end of the shank 69 which extends into the tube 15 is exteriorly threaded to receive a nut 74 by means of which the ball is drawn into position and rigidly secured to the head 72, the shoulder 70 limiting its movement in one direction. The nut 74 corresponds to the boss 21 of Figs. 1 and 6, and an annular channel is formed which may be connected with the groove 80, it being of course obvious that the cap and springs shown in Fig. 6 may, if desired, be supplied in each case to keep the lubricant under pressure. In order to form a socket for the ball 63 I provide a concave recess 75 at the center of the top face of the chilled cast iron drill 66, and an annular socket member 76 forming a clamping device for the ball is provided with a concave face 77 so that it will fit around the portion of the ball adjacent the neck thereof. When the member 76 is passed over the shank 69 of the ball and is secured to the top face of the drill or bit 66, by means of the bolts 78, a retaining socket for the ball will be formed by the two registering concave recesses which will permit the universal movement of the bit as the drill-head is rotated. Of course, it will be understood that the member 76 may be made of two halves, if desired, but it is preferable to make the same in one piece as shown, thus forming a more rigid construction. The enlarged part 69 is turned down sufficiently to allow the piece 76 to slip over it. A ridge 79 works in a groove 80 of varying depth located in the bottom face of the drill-head 72, whereby a wabbling movement is imparted to the bit to cut the earth or rock. Similarly to the construction shown in Figs. 6 and 7, a lubricant containing groove 54 is provided and the channels 83 and 84 lead therefrom to the groove 80 in the underside of the drill head.

The operation of the device will be apparent from the foregoing description. When the drill-head is rotated, if the material or earth operated upon is comparatively soft, the drill may rotate to some extent with the head and if the same is used in boring rock a wabbling motion will be imparted to the bit, so as to cause an abrading action by the abrading surface on the face of the drill or bit, the drill being what I choose to term a "wabble drill". The arrangement disclosed is such that when the drill-head is rotated about its vertical axis, which coincides with the axis of the well, the cutter connected to the drill-head by the ball and socket connection wabbles and the axis thereof travels on an imaginary upright substantially conical surface, the axis of said conical surface coinciding with the axis of the drill-head, and the apex of the cone being uppermost and coincident with the axis of the drill-head. The intersection of the axis of the cutter and the axis of the drill-head is fixed and substantially stationary and located at the center of said ball and socket joint. The peripheral edge of the drill or cutter is also substantially coextensive with the peripheral edge of the drill-head and the abutting bearing portions of the drill and drill-head are concentric with the axis of the drill-head and the planes of said bearing portions are inclined to said axis. It will be seen that during the operation when the drill strikes some hard substance the drill head may keep on turning and will wabble the drill so that any particular point of the drill or cutter will move in the circumference of a small circle which forms the base of a right cone whose apex is at the center of the ball and socket joint, that is, at the intersection of the axes of the drill and the drill head. The rock and sand that is dislocated is washed to the surface by water pumped through the tubular part 15 and through the head, connections and drill, forcing the cuttings upward outside of the drill and tube 15.

It is to be understood that while I have specified the use of castings for the parts comprising the drill, the use of hardened steel or other material suitable for the purpose is contemplated and it is intended that the term "casting" shall include all such equivalents.

It will be apparent that numerous changes may be made in the device without departing from the spirit of the invention and therefore I do not wish to be limited to the exact details as shown and described.

Having thus described the invention what is claimed as new is:

1. In a rock drill, the combination of a drill-head having a cavity in the bottom face thereof, a drill or bit having a part bearing against the bottom face of the drill-head, and means for connecting the drill to the drill-head comprising a head on one of said members extending into said cavity, and a clamping device secured to the other member and engaging said head to fasten the drill to the drill-head.

2. In a rock drill, the combination of a drill-head having a bottom face provided with a groove lying in a plane inclined to the axis of the drill-head, a drill connected to the drill-head and having on its upper face means fitting said groove and provided with teeth on the bottom face thereof, said drill-head having a closed chamber therein for lubricating material and also having passageways leading from said chamber to the groove in the bottom face thereof.

3. In a rock drill, the combination of a drill-head rotatable about its vertical axis which coincides with the axis of the well,

the bottom face of said drill-head having a portion inclined to the axis of the drill-head, a drill or cutter having on its upper side means bearing against said inclined portion of the drill-head, the upper side of the drill being substantially the same diameter as the bottom face of the drill-head, said drill having a toothed convex bottom face, and a ball and socket joint connecting the drill to the drill-head, the intersection of the axis of the drill and the axis of the drill head being fixed and located at the center of the ball and socket joint, the axis of the drill traveling around the axis of the drill head below the ball and socket joint.

4. In a rock drill, the combination of a drill-head rotatable about its vertical axis which coincides with the axis of the well drilled, said drill-head having a groove in its bottom face the plane of which is inclined to the axis of the drill-head and having a cavity in the bottom face thereof, said drill-head also having a closed lubricant chamber therein connected by passages to the inclined groove in the bottom face thereof, a drill or cutter having a circular rib on the top face thereof fitting said groove in the drill-head, and also having a convex bottom face provided with teeth, and means for connecting said drill to the drill-head comprising a ball and socket joint having portions thereof located in the cavity in the bottom face of the drill-head.

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

AUGUST GERDES.

Witnesses:
DAVID LEMLEY,
L. C. NACHN.