R. O. PICKIN.

ROTARY ROCK DRILL BIT.

APPLICATION FILED JUNE 15, 1917.

1,334,632. Patented Mar. 23, 1920.

Fig. 1

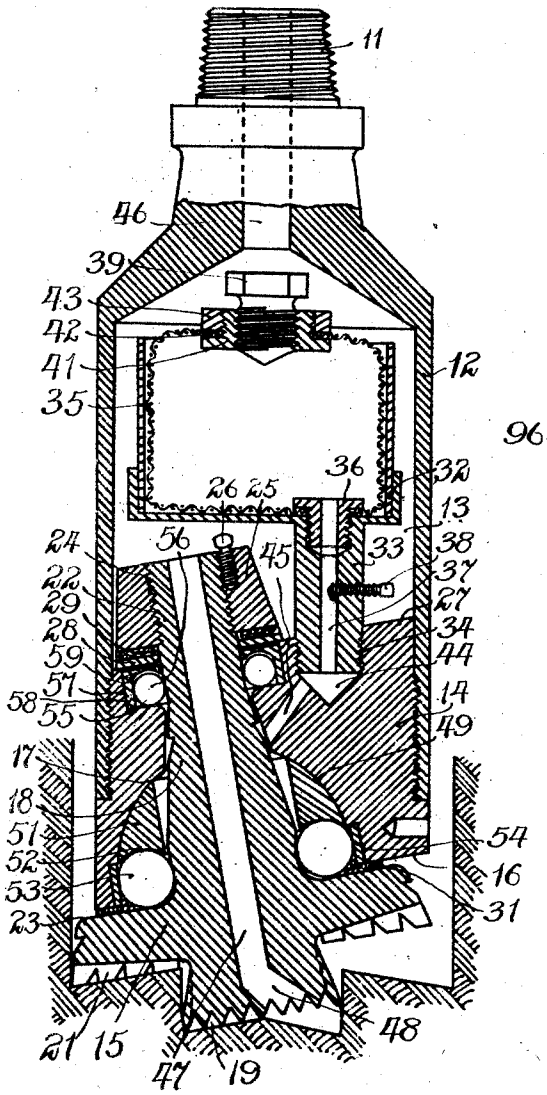
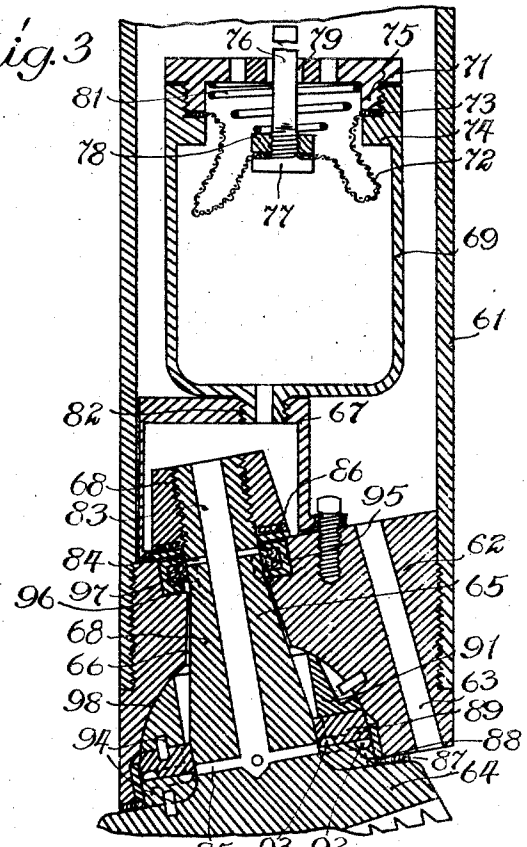


Fig. 3



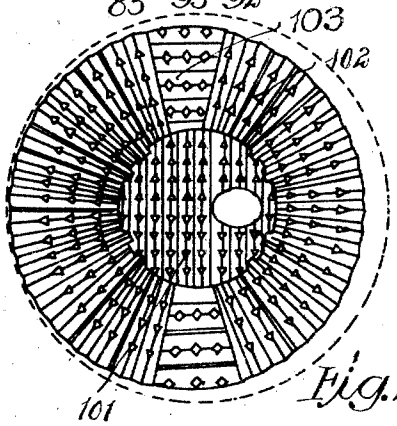


Fig. 2

INVENTOR

Rowland O. Pickin

BY

Monday, Clarke & Carpenter

ATTORNEY

UNITED STATES PATENT OFFICE.

ROWLAND O. PICKIN, OF SEATTLE, WASHINGTON.

ROTARY ROCK-DRILL BIT.

1,334,632. Specification of Letters Patent. Patented Mar. 23, 1920.

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To all whom it may concern:

Be it known that I, ROWLAND O. PICKIN, a subject of the King of Great Britain, residing in Seattle, in the county of King and State of Washington, have invented a new and useful Improvement in Rotary Rock-Drill Bits, of which the following is a specification.

This invention relates in general to improvements in rotary rock drill bits, and more particularly to bits in which the head of a boring tool carries a cutter mounted at an incline and rotating about an axis oblique with respect to the axis of the hole and drill rod.

A principal object of the invention is the provision of certain improvements more particularly hereinafter described and designed to increase the efficiency and economy of operation of such a tool.

This invention contemplates the provision of a rotary detachable equalizing bearing for holding the tool or cutter in the drill head and designed to insure an even distribution of the pressure on the cutter, and, at the same time, materially reducing the incidental friction.

A still further object of the invention is the provision of an improved system of lubrication together with the appropriate devices for improving the general operation and adapted to prevent the entrance of grit or mud-laden water or fluid between the relatively moving surfaces.

A still further object of the invention is the provision of a lubricating system which will economize in the consumption of lubricant by preventing escape of the lubricant during the drill operations.

Still another object of the invention is the provision of a drill in which the parts may be readily removed for repairing or replacement when said parts become worn or damaged in use.

Other objects and advantages of the invention will be apparent as it is better understood from the following description when considered in connection with the accompanying drawing illustrating a preferred embodiment thereof.

On the drawings,

Figure 1 is a vertical sectional view taken on the axis of the cutter and hole or boring of an embodiment of my present invention;

Fig. 2 is a bottom plan view of the cutter showing a preferred arrangement of the teeth; and

Fig. 3 is a vertical sectional view similar to Fig. 1 showing a slightly modified form.

It will be understood that a drill constructed in accordance with my invention comprises a drill member carrying the operative parts and secured in the end of a vertically disposed rod or shaft, which, since this general arrangement is well known to those skilled in the art, is not shown on the drawing. The member in the present instance comprises a threaded shank 11 adapted to be secured into the end of a shaft or otherwise coupled thereto and extending up from a hollow casing head 12. This head is provided with an interior cavity 13 closed at its bottom with a plug or bearing head proper 14 carrying a cutter 15. The lower face 16 of the plug 14 is inclined at an appropriate incline and is provided with a perforation or opening 17 through which a shank 18 of the cutter extends. The cutter in the present instance is provided with a pair of flat cutting faces 19 and 21, being located substantially at the intersection of the axes of the cutter and of the casing 12, this intersection of the axes providing the center of gyration and the general construction arranging the center of gyration in the lowermost cutting face. The cutter is preferably of one piece and is formed to provide a shank 22 extending through the opening or perforation 17 in which said shank or shaft has a bearing for independent rotation. The body of the cutter, *i. e.*, that part above the cutting face 21 has a rear flat surface providing a bearing face 23 adapted to engage the under inclined face 16 of the plug 14 and the upper end of the cutter shank is threaded at 24 to receive a holding nut 25 and lock tap screw 26 for holding the cutter in place and against excessive longitudinal movement. Packing is provided between the nut 25 and the plug and also between the head of the cutter, and between the faces 16 and 23. Considering first the packing between the nut 25 and the upper face 27 of the plug, it will be noted that a washer 28 is disposed about the shank 18 and upon this are located yielding packing rings 29 adapted to prevent the passage of water and lubri-

cant. A similar packing ring 31 is disposed between the faces 23 and 16. Lubricant is confined within the plug and in contact with the shank of the cutter, and the structure is so constructed to permit water to flow through the cutter and out around the outside of the teeth, as will be later described.

A lubricating device is located within the hollow head 12. In the form of the invention shown in Fig. 1 this lubricating device comprises a rigid container 32 carried upon a stem 33 screwed into the open portion of the plug 14 at 34. This lubricating device is open at its top and it is intended to contain a more or less solid or semi-solid grease. This grease is preferably confined within a canvas or other flexible covering 35. A hollow plug 36 is provided through the bottom of the canvas or yielding container and screws into the stem 33. The stem 33 is provided with a longitudinally extending passageway 37 communicating with the hollow interior of the plug 36. A set screw 38 is provided through the side of the stem 33 to control the passage of lubricant. The canvas or other yielding covering carries a weight adapted to bear down upon the grease and the vibration of the said weight forces the grease down through the stem as it may be required for use. This weight in the present instance comprises a heavy bolt 39 screwed into a sleeve or collar 41 having a flange 42 located within the flexible covering of the grease, a collar 43 being provided to screw down against the flange and hold the weight in place with respect to the material of the cover.

A cavity 44 is located beneath the end of the stem 33 and the grease passing through the stem moves into this cavity and from the cavity through a passageway 45 passes into the perforation or opening 17. Here it is confined by the packing earlier described and it is intended that the entire available space within this opening be filled with the lubricant, the packing preventing the lubricant from exuding out either at the top or bottom.

A flow of water is maintained in the cutter, being admitted to the cavity of the hollow head 12 through a passageway 46 down through the stem 11. The water circulates in and about cavity 13 and passes out through a passageway 47 through the cutter, the lower opening 48 of this passageway being inclined to bring it away from the center of operation of the tool.

Equalizing bearings are provided in the plug 14 to equalize the thrust of the pressure resulting from the operation of the tool. The lower portion of the perforation or opening 17 is enlarged and given a spherical curvature, as indicated at 49 in Fig. 1, and in this enlargement is inserted a thrust ring 51 having an under face 52 curved to engage bearing balls 53 positioned between the face 23 of the cutter and the lower curved face of the bearing ring 51 and the adjoining faces of the bearing ring and plug so that a proper fit is readily obtained. The side thrust of the balls is taken up by a second thrust ring 54, mounted also within the plug 14. The curved contacting faces 49 permit the bearing ring to adjust itself and distribute the thrust evenly as will be later more fully explained. An enlargement 55 of the opening 17 is also made at the top and in this enlargement are located bearing balls 56 which engage a thrust ring 57 comprising an outer flange 58 and an overhanging part 59, which overhanging part is located just beneath the washer 28, already described.

Considering now the slightly modified embodiment of the invention shown in Fig. 3, it will be noted that the hollow head indicated at 61 is a substantial duplicate of the hollow head 12 of the form shown in Fig. 1. The plug 62 is mounted similarly to the plug 14 and differs therefrom in the present instance in that this plug is provided with a water passage 63 which does not pass through the cutter itself. In this form of the invention the water is kept from contact with the upper end of the shank of the cutter. The cutter indicated at 64 has the shape and general characteristics of the cutter 15 and is similarly mounted through the plug 62, its shaft or shank 65 extending through an opening 66 in the plug. A housing 67 excludes the water from contact with the upper end of the shank which is held in place by a nut 68 in the manner already described. The housing 67 carries a rigid lubricant container 69 having a cap 71 at its top. The grease within the container 69 is also provided with a covering of canvas or other flexible covering 72, which in the present instance however does not infold the lubricant, consisting merely of a sheet secured at its edge 73 between a flange 74 of the container and the lower end of the threaded neck 75 of the cap. A weight 76 is carried by this covering, and in the present instance, this weight consists of a bolt having a head 77 within the covering and a collar 78 secured down thereagainst to hold the material of the covering to the weight. The body of the weight consists of the stem which extends up through an opening 79 in the cap. If desired, a spring 81 may be positioned beneath the cap and in engagement with the cap and with the collar 78, tending thereby to force the covering down to compress the oil or lubricant against the bearing. The container 69 is provided with a hollow threaded stem 82 extending up through the top of the housing 67 so that the action of the weight and spring is to keep the housing full of lubricant. A lubricating pas-

sageway 83 passes down into the stem and branch passageways 84 and 85 take off at appropriate locations.

Packing rings 86 and 87 are provided similar to packing rings 29 and 31 and similarly located.

The internal shape of the opening 66 is identical with the opening 17 and the parts about to be described and mounted therein may be considered to be interchangeable with the similar or analogous parts already described and located in the opening 17, slide rings, however, being used in place of the bearing balls. These slide rings each consist of a pair of rings 88 and 89, the lower one 88 being arranged to fit close about the shank against the rear face of the cutter and the upper one being adapted to rest thereupon and beneath a thrust ring 91 of shape substantially that of the thrust ring 51, except that the lower face is flat instead of curved. Each ring is provided with an encircling lubricating groove 92 and with cross-grooves 93 indicated in dotted lines and communicating with the passageway 85 from the passageway 83 in the shank of the cutter. If desired, keys 94 can be provided for preventing independent rotation of the thrust ring with respect to the plug and independent rotation of the slide rings with respect to the thrust ring and cutter respectively. A ring 95 is positioned in the enlargement 96, which is identical with the enlargement 55 of the earlier described embodiment. The ring 95 is provided with a channel in which is positioned packing or other lubricant absorbent material communicating with the passageways 84. The contacting faces 98 between the thrust ring 91 and the plug 62, and the analogous contacting faces in the earlier embodiment, are curved to spherical form so that these faces may move over each other to equalize the thrust as the parts may wear slightly, and, this, of course, whether the ball bearing arrangement shown in Fig. 1 or the slide bearing arrangement shown in Fig. 3 be used.

The invention also contemplates an improved arrangement of the teeth of the cutter, which is shown in Fig. 2, from which it will be noted that on the lower face 19, the teeth are formed of serrated ribs 101 extending parallelly with each other across the entire face and the face 21 is provided with a plurality of ribs 102 arranged radially and a plurality of ribs 103 arranged in parallelism. It will be noted by comparing Figs. 1 and 2 that the cutter has a roller action over a surface of greater diameter than the cutter itself and this diversified arrangement of the teeth causes an ever-changing presentation to the surface being operated upon. The action is a crushing one as counter-distinguished from a scraping one, and this arrangement of the teeth prevents the formation of a ribbed surface beneath the cutter corresponding in some degree to the hills and valleys provided by the ribs. The ribs 101 are serrated at intervals to set-off individual teeth. These serrations extend spirally as indicated in the drawing.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing any of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a rock drill, the combination of a head, a cutter mounted for independent rotation in said head and having a shank extending therethrough, bearing devices between said cutter and said head, and a thrust equalizer for transmitting the thrust of said cutter through said head.

2. In a rock drill, the combination of a head, a cutter mounted for independent rotation and having a shank extending into said head, and a spherical bearing about said shank for equalizing pressure of said cutter transmitted to said head.

3. In a rock drill, the combination of a head, a cutter mounted for independent rotation, a stem connection between said cutter and head, and an equalizer embracing said stem and equalizing the pressure transmitted by said cutter to said head.

4. In a rock drill, the combination of a head, a cutter mounted for independent rotation and having a stem extending through an opening in said head, and an equalizer engaging said head, the contacting faces of said equalizer and said head being spherical to equalize the thrust of said cutter on said head.

5. In a rock drill, the combination of a head, a cutter having a stem extending through said head and independently rotatable thereon, means for supplying lubricant within said head and about said stem, and means for excluding water and grit from about said stem within said head.

6. In a rock drill, the combination of a head, a cutter having a stem disposed through said head, a nut engaging said stem beyond the head, and a yielding packing located between said nut and said head and the body of said cutter and said head.

7. A cutter for a rock drill comprising a cutting face having a plurality of radially extending teeth and a plurality of parallelly extending teeth arranged in a plurality of parallel planes.

8. A cutter for a rock drill comprising

two tiers of cutting faces having a combination of teeth arranged radially, spirally and parallelly with respect to each other.

9. In a rock drill, the combination of a head, a cutter mounted for independent rotation in the head, and a thrust equalizer for transmitting equally the thrust to said cutter through said head.

10. In a rock drill, the combination of a head, a cutter mounted for independent rotation therein, and a spherical equalizer for equalizing pressure of said cutter transmitted to said head.

Signed in the presence of two subscribing witnesses.

ROWLAND O. PICKIN.

Witnesses:
Mrs. JESSE M. LIGHTFOOT,
V. A. MONTGOMERY.