

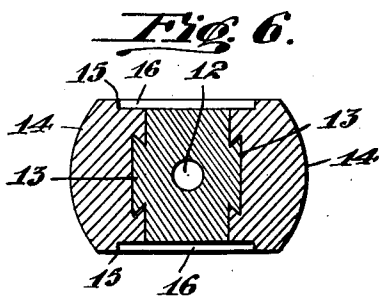
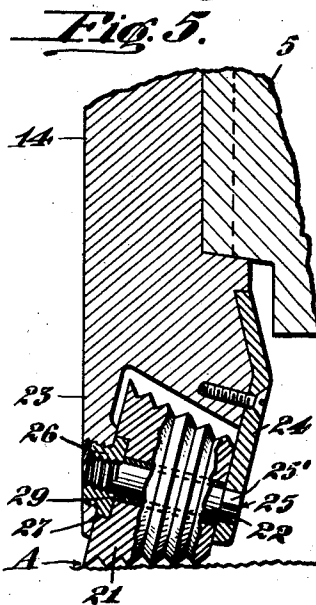
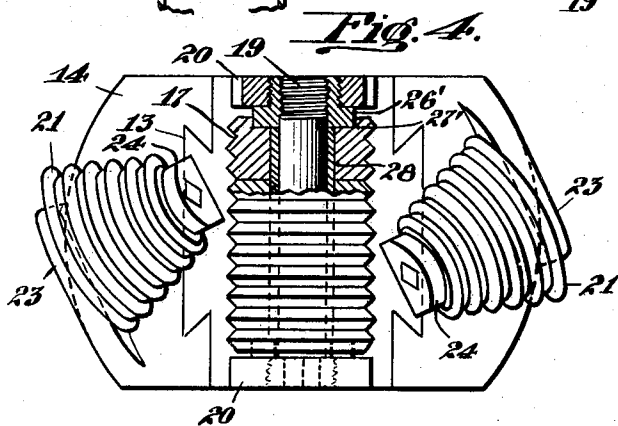
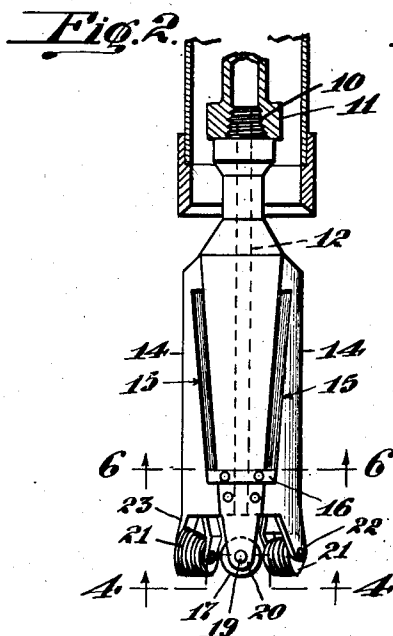
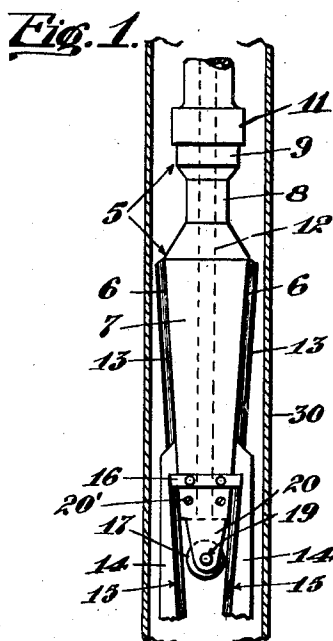
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DRILL

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UNITED STATES PATENT OFFICE.

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DRILL.

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This invention relates to a rotary drill and more particularly it relates to the formation, configuration of, and positioning, and fastening means for, the actual drilling members of a drill and is an improvement on a rotary drill described and claimed in Patent #1,468,509 granted to me September 18, 1923.

10 An object of this invention is to provide a rotary drill having drilling members of improved configuration and position.

Another object of this invention is to provide improved means for detachably securing certain of said drilling members to 15 their supporting parts.

Another object of this invention is to provide cutting members of a rotary drill which necessitate less lubrication than those previously employed.

20 A further object of this invention is the provision of more durable drilling members.

A still further object of this invention is to provide a rotary drill with tools which are renewable and interchangeable and 25 which may be readily removed.

Another object is to provide a well-drilling tool of the rotary type embodying a series of revolvable elements on the tip thereof, so constructed and arranged as to 30 effect a drilling action by the crushing and comminuting of the materials worked upon so that the materials may be readily discharged in water.

Another object is to provide a well-drilling 35 ing tool of the rotary type with crushing and grinding rollers so arranged relative to each other and to the vertical axis of rotation of the drill that the material acted on thereby will not be only finely ground but 40 also thoroughly admixed with water so that the water and the solids may be readily removed.

Another object is to provide a tool of the above character which is so constructed as 45 to insure drilling of a straight hole, which is rapid in operation, and adapted for use in various earth formations.

A further object is to provide a tool with an arrangement of bearing rollers whereby 50 an undercutting action may be readily effected, for the purpose of allowing the casing to follow the tool during the operation

of the drilling, and embodying means whereby the tool may be expanded and contracted. 55

Other objects will appear hereinafter.

The invention is illustrated in the accompanying drawings, in which—

Fig. 1 is a view showing a well casing in section, with a portion of the tool disposed 60 therein in contracted position.

Fig. 2 is a view in elevation of the tool in its expanded position.

Fig. 3 is a view in side elevation of the tool. 65

Fig. 4 is an end view taken on the line 4—4 of Fig. 2, showing the arrangement of the boring rolls.

Fig. 5 is a central longitudinal section of a complementary crushing roller taken on the 70 line 5—5 of Fig. 3, and showing a method of securing the roller to a portion of the tool.

Fig. 6 is a view in transverse section as seen on the line 6—6 of Fig. 2.

More specifically, in Fig. 1, 5 indicates the 75 shank of the tool, the lower portion of which is wedge-shape in form to provide inclined or tapered side walls 6 on opposing sides thereof, the end walls 7 of the shank being straight and parallel. The upper portion 80 of the shank converges into a square stem 8 fitted with an annular flange 9 forming the upper end of the shank and on which flange is formed a tapered threaded portion 10 (shown in Fig. 2) adapted to be screwed 85 into the lower end of a tubular drill rod 11 by which the drill is suspended and operated as is common in rotary drill operation. The shank is formed with a longitudinal bore 12 extending throughout the 90 length thereof and communicating with the interior of the drill rod 11 through which water may be passed downwardly and discharged from the lower end of the drill centrally thereof. Formed on the inclined sides 6 of the shank 5 are dove-tail ribs 13 which 95 extend longitudinally of the shank and are adapted to engage dove-tail grooves formed on the inner inclined faces of a pair of slips 14, which are designed to be slidably mounted 100 on the inclined faces 6 of the shank. The sides of the slips 14 are preferably flush with the flat end faces of the shank, as shown in Fig. 4, so that the slips and the

shank will have a corresponding width. Formed on the sides of the slips 14 are vertically extending channels 15 into which the ends of a cross bar 16 project, a cross bar 16 being mounted on each flat end face 7 of the shank and countersunk therein. These cross bars are designed to limit the longitudinal movement of the slips and shank relative to each other and are adapted to engage the upper ends of the channels 15 as shown in Fig. 1, or to abut against the lower ends of the channel, as shown in Fig. 2, according to whether the surface is contracted or expanded relative to each other on the shank, as will be described later.

Mounted on the lower end of the shank 5 is a series of case hardened corrugated rollers 17 of uniform diameter rotatably mounted on a shaft 19 supported in projections 20 on the end of the shank. The projections 20 comprise demountable plates which are countersunk in the faces 7 of the shank 5 and are secured thereto by screws 20. Mounted on the end of each slip 14 with its largest diameter outermost is a case-hardened tapered corrugated roller 21 which is designed to rotate on a shaft 22 as shown in Fig. 5. The shaft 22 is carried at one end by a projection 23 on the lower outer portion of the slip 14 and at its inner end by an angular plate 24 having a square aperture 25 therein in which a squared end portion 25' of the shaft 22 extends. The plate 24 is detachably affixed to the inner side of the slip 14, the dove tail rib 13 being cut to accommodate the plate. The shaft 22 is positioned in its bearing at such angle that the bottom line A of the tapered roller 21 is at right angles to the axis of the drill and therefore at right angles to the direction of drilling. The rollers 17 and 21 are formed with peripheral ribs and grooves so as to adapt the rollers to have simultaneously a crushing and a grinding action during the rotation of the drill.

As a means for affording a substantial mounting for the outer ends of the shafts 22, the projections 23 are provided with inwardly extending nuts or collars 26 the round heads of which project into recesses 27 in the outer ends of the rollers 21, so that the rollers will extend close to the edges of the slips, and the shaft bearings will not project materially beyond the outer faces thereof, this construction providing wide bearings for the shaft. The nuts or collars 26 are internally threaded, their headed portions rest upon the inner face of the projection 23, and the shafts 22 are screwed into engagement therewith to permit ready removal and replacement of the shafts and rollers. The shaft 19 is mounted in a manner similar to that of the shafts 22, one end thereof being screwed into a collar 26 carried by a projection 20 which collar extends

into a recess 27 in the end roller 17. The other end of the shaft 19 is squared and extends into a square hole in a collar carried by the other plate 20.

The rollers 17 and 21 are provided with bushings 28 and 29 which extend from their inner end portions to the shoulders formed by the recesses 27. The rollers 21 are preferably arranged diagonally to the rollers 17 and to their arcuate path of travel so that when the drill is rotated with the rollers 21 bearing on the bottom of the well, these rollers will both rotate and slide in traversing the surface to effect a crushing and grinding action thereon. The rollers 21 are arranged so that a portion of their enlarged outer ends will project diagonally beyond the outer faces of the slips so that during rotation of the drill they will cut a diameter greater than that of the combined slips and shanks and thereby afford clearance between the walls of the bore and the slips. This bore is cut under the lower end of the casing to permit the latter being lowered therein.

In the operation of the invention, the slips are advanced on the shank so that they will extend beyond the lower end thereof, in which position they will be contracted relative to each other by reason of the inclination or taper of their slide mounting. When thus disposed the slips will be supported on the cross bars 16. The drill may then be raised or lowered through the well casing 30, as shown in Fig. 1. When the slips come to rest on the bottom of the bore the shank may be lowered between the slips and by reason of its wedge shape cause the slips to move outwardly into their expanded position below the lower end of the casing. When the shank is in its lowermost position between the slips, the cross bar 16 will abut against the lower ends of the channels 15 so that the shank of the drill and the load imposed thereon will bear upon the slips. The shank and slips are so proportioned that when the shank is in its lowermost position between the slips, the several rollers will be positioned on the same plane.

During rotation of the drill, half of the series of rollers 17 will rotate on their shaft in an opposite direction to the other half and by extending diametrically across the axis of rotation of the drill will form the central portion of the bore. The rollers 21 being arranged with their outer ends disposed beyond the path of travel of the outer ends of the inner rollers 17 will act to form the walls of the bore. The boring action of the drill consists in crushing and grinding the materials acted on by the rollers rather than by cutting, which action is facilitated by reason of the drill being heavily weighted and by the corrugated formation of the rollers thus adapting the tool for use in

various formation. The materials acted on by the rollers being finely ground will be thoroughly commingled with the water delivered to the lower end of the drill through the shank and drill rod so that the débris may be readily removed on discharging the water from the bore.

It will be noted that according to my construction the rollers do not roll free, but slide and roll, and that my peculiar construction provides a device which minimizes the wear between the roller and the shaft, a condition which calls for a relatively small amount of lubrication. My construction also provides a device in which the bits are given lengthened life. Another valuable effect of my improved drill is that during action it effects simultaneously a crushing and a shearing action and thereby brings about an easily removable admixture of the débris with the water introduced into the drill, which may be readily removed from the well. This effect is in striking contrast to previous drills wherein the rollers rolled

but did not slide over the surface to be cut, an action which tended to pack the material cut, and thus tending to prevent its mixture with the water intended to wash away the débris.

I claim—

In a rotary drill, a slip having an integral tapering end projection on its outer lower end portion, a nut screwed into the inner face of said projection, said nut having a round head adapted to form a bearing surface and being internally threaded, a shaft having one of its ends screwed into said nut to be operatively non-rotatable, a rotatable corrugated drilling roller supported by said shaft and having a portion of its bearing upon the head of said nut, the axis of rotation of said roller being in such a direction as to tend in operation to force said roller toward the outer face of said slip, and a support for the other end of said shaft.

ROSCOE E. OVERMAN.