April 5, 1932. E. E. GREVE 1,852,843

EARTH DRILLING BIT

Filed July 7, 1925 2 Sheets-Sheet 1

Fig. 1

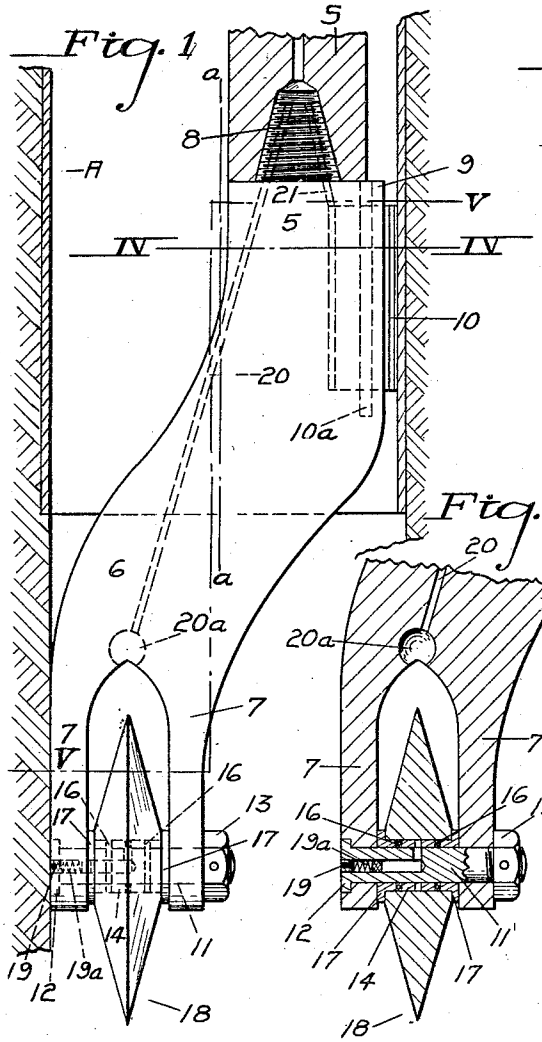


Fig. 3

Fig. 2

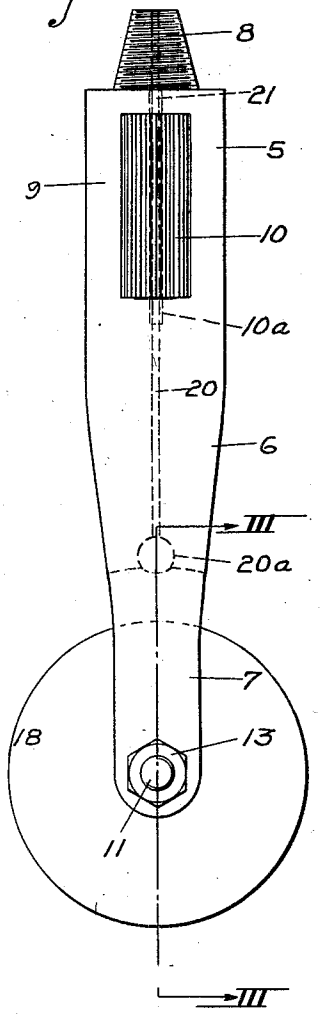
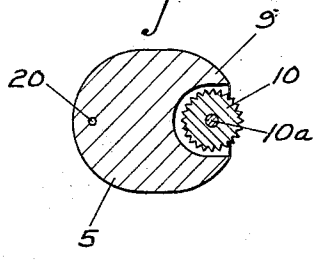


Fig. 4



INVENTOR.
E. E. Greve
BY
W. F. Doolittle
ATTORNEY.

April 5, 1932. E. E. GREVE 1,852,843

EARTH DRILLING BIT

Filed July 7, 1925 2 Sheets-Sheet 2

Fig. 6.

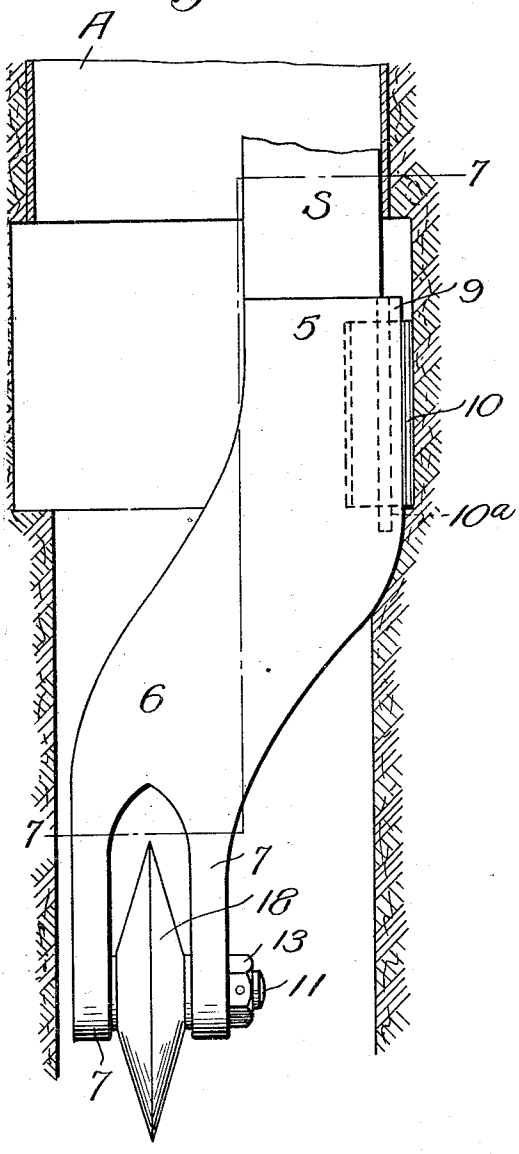


Fig. 5.

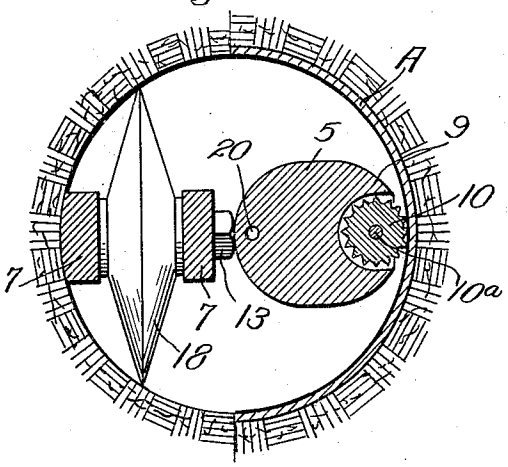
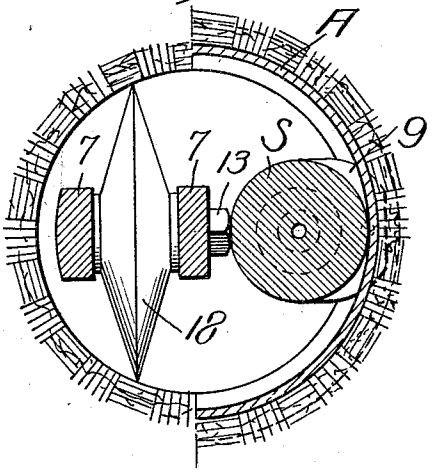


Fig. 7.



Inventor,

E. E. Greve

By W. F. Doolittle

Attorney.

Patented Apr. 5, 1932 1,852,843

UNITED STATES PATENT OFFICE

EDGAR E. GREVE, OF BELLEVUE, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO OIL WELL SUPPLY COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF NEW JERSEY

EARTH DRILLING BIT

Application filed July 7, 1925. Serial No. 41,961.

This invention is for a rotary earth drilling bit for use in rotary earth boring operations.

Various types of bits used in rotary well drilling have been devised in order to make drilling as safe and as rapid as possible. The present invention has for its principal object to provide a bit of the revolving disk type designed to cut a maximum size of hole with a minimum number of wearing parts and which will be less liable to become clogged than bits of this general type now in use.

The invention has for a further object to provide a bit having a heel portion which will bear against one side of the hole, to urge the cutting disk against the other side, and to so construct the heel that it may function to ream the wall after the cutter has formed the hole.

A further object of the invention is to provide novel means for lubricating and cleaning the cutter disk.

These and other objects and advantages are attained by my invention, which may be readily understood by reference to the accompanying drawings.

In the drawings:

Figure 1 represents a side elevation of the tool, this figure representing the tool as being in a hole.

Figure 2 is a front elevation of the tool looking directly at the heel thereof.

Figure 3 represents a vertical section in the plane of line III—III of Fig. 2.

Figure 4 is a transverse horizontal section in the plane of line IV—IV of Fig. 1.

Figure 5 is a sectional view taken on the line V—V of Figure 1.

Figure 6 is a view similar to Figure 1 but showing the bit in a lower position to illustrate its under-reaming function, and

Figure 7 is a cross sectional view taken on the line 7—7 of Figure 6.

Referring to the drawings, 5 designates the upper end of a body having a laterally offset inclined portion 6 acting as a crank arm. At the lower end of the crank arm 6 is a substantially vertical bifurcated extension 7. On the upper end of the body is an integral pin connection 8 of a standard type by means of which the body may be secured to the end of a drilling string, S. The upper end of the body is provided with a heel portion 9 in which a serrated roller 10 may, when desired, be provided, the heel portion 9 being eccentric to the axis of the crank.

Passing through the legs of the bifurcated lower end of the body is a shaft 11 which preferably has a head 12 on its outer end countersunk in the outer leg of the body. On the inner end of the shaft is a suitable securing means, such for instance as nut 13. On the shaft, between the two legs of the body is a sleeve or bushing 14 having perforations therethrough as shown. At each end of the bushing is a packing ring 16 and a flanged retainer 17. A disk cutter 18 is rotatably fitted over the bushing.

In the shaft 11 there is preferably a coaxially arranged chamber or bore terminating at its inner end in a suitable radial passage opening into bushing 14. A plug 19 closes the outer end of this chamber, while a spring-pressed lubricant ejector 19*a* may be provided in the chamber as shown. Heavy grease may be used as a lubricant, and the arrangement shown provides a substantially dirt proof self-lubricating bearing for the disk.

In the body are passages 20 and 21 leading from the top of the pin connection to a point above the disk and to a point adjacent the reaming roller 10, respectively. Passage 20 is preferably enlarged at its discharge end, as indicated at 20*a* to ensure a proper direction of the fluid pumped through the passage 20 against the disk to clean it, even when the drill is otherwise well clogged up with clay, etc. The stream of muddy water usually forced down the drill stem in any system of rotary drilling is the fluid directed through passages 20 and 21 to loosen material that tends to cake and compact about the operating parts of the bit.

The operation of the drill may be best understood by reference to Fig. 1 which represents the drill in a hole just below the end of a pipe or casing. The bit is of such width that the crank cannot be centered in the casing A, so that, as it is lowered, the disk

bears against one side of the pipe or casing while the heel 9, or the roller 10 therein, bears against the other side. This of course requires that the drilling stem be flexed out of a true central position. When the drill reaches the bottom of the hole, the drill stem is rotated, revolving the crank arm 6 with the cutting disk. The disk is forced to travel in a circular path because of the fact that the heel, or roller 10 in the heel, always bears against the side of the hole diametrically opposite and above the disk, causing the disk to be forced to the other side of the hole. In other words, the dot-and-dash line *a*—*a* of Fig. 1 represents the axis of rotation of the tool, and both the connecting pin and the disk are eccentric to the axis. While such arrangement causes an eccentric motion in the drill string, its great length and relatively flexible nature permits of such motion without injury thereto.

As the depth of the hole increases below the casing, the roller 10, bearing against the sides of the hole, reams or smooths the hole as the drilling progresses. More specifically, when the tool is lowered and cutter 18 engages the earth below the casing, it cuts a hole equal to the inside diameter of the casing for the reason that roller 10 and the outer leg of bifurcated extension 7 are in contact with the casing as shown in Figure 5. As the cutter bites into the earth, there is a tendency for it to remain stationary and turn about its vertical axis. By virtue of the eccentricity of the tool, the reaction of the lower point of contact of the cutter and the downward force, due to the weight of the drill string, produce a couple which tends to cant the tool. This action maintains the roller 10 in contact with the casing during the rotation of the drill string and tool. However, when the roller 10 reaches a point below the casing A, the force couple causes the lower portion of drill string S to contact with the casing as in Figures 6 and 7, whereby cutter 18 cuts a smaller hole and the roller 10 underreams a hole of larger diameter than casing A. As a result, drilling and underreaming are accomplished with one tool.

It may be noted that the roller 10 is preferably carried on a vertical pin 10*a* and it is preferably received in a suitable pocket in the body so that only its periphery projects beyond the body. The pin 10*a* is preferably so disposed as to be covered by the end of the drill string, S, as shown in Fig. 1, whereby it can not work up or be removed without the joint first being separated. The roller 10 may be removed whenever it is desirable to do so to replace it, or to permit the bit to operate without the reamer.

I claim as my invention:—

1. An underreaming bit including a body of attenuate form having its end portions disalined, means for attaching one of said portions to a drilling string, an underreaming cutter carried by the latter end and projecting outwardly beyond a side thereof so as to function in a position below the drill casing, and a disc cutter carried by the other end portion with its axis disposed transversely of the drill casing, said disc cutter being adapted to cut a bore hole of one diameter when the underreaming cutter is within the casing and to cut a bore hole of less diameter when the underreaming cutter is below the casing.

2. An underreaming drill comprising a body, an underreaming cutter rotatably mounted in one end of said body for rotation about a longitudinal axis, and a disc cutter rotatably mounted in the other end of said body for rotation about a horizontal axis, said cutters being positioned on substantially diametrically opposite sides of the axis of rotation of the drill, the drill forming a bore by means of said two cutters only.

3. In combination with a casing, rotary drilling apparatus including rotatable driving means extending within the casing, and a drill comprising a body having an upper heel portion operatively connected to said driving means to be rotated thereby said heel portion engaging said casing to direct the body orbitally about the axis of the casing and a crank shaped lower portion, and a cutter rotatably mounted in the crank shaped portion of the body for rotation about a transverse axis.

4. In combination with a casing, rotary drilling apparatus including rotatable driving means extending within the casing, and a drill comprising a body having an upper heel portion operatively connected to said driving means to be rotated thereby said heel portion engaging said casing to direct the body orbitally about the axis of the casing and an offset lower portion, said upper and lower portions being substantially wholly disposed on substantially diametrically opposite sides of the axis of the casing, and a disc cutter rotatably mounted in the offset lower portion of the body for rotation about a transverse axis.

5. In combination with a casing, rotary drilling apparatus including rotatable driving means extending longitudinally within the casing, and a drill comprising a body having an upper heel portion operatively connected to said driving means to be rotated thereby said heel portion engaging said casing to direct the body orbitally about the axis of the casing and an offset lower portion, said upper and lower portions being substantially wholly disposed on substantially diametrically opposite sides of the axis of the casing and a cutter rotatably mounted in the offset lower portion of the body.

6. An underreaming drill comprising a body having an upper portion provided with

a connection for securing the drill to a drilling string, a cutter mounted in said portion for rotation about a longitudinal axis, the lower portion of said body being offset from the upper portion, a cutter mounted in the lower portion to rotate on a transverse axis, said cutters being positioned on substantially diametrically opposite sides of the axis of rotation of the drill, the drill forming a bore by means of said two cutters only.

7. An underreaming drill comprising a body having an upper portion provided with a connection for securing the drill to a drilling string, a cutter mounted in said portion for rotation about a longitudinal axis, the lower portion of said body being offset from the upper portion, a cutter mounted in the lower portion to rotate on a transverse axis, said cutters being positioned on substantially diametrically opposite sides of the axis of rotation of the drill and at different radial distances therefrom, the drill forming a bore by means of said two cutters only.

8. An underreaming drill comprising a body having an upper portion for connection to a drilling string to be rotated thereby, a cutter rotatably mounted in said upper portion for rotation about a longitudinal axis, said body having an offset lower portion, and a cutter rotatably mounted in the offset portion of the body for rotation about a transverse axis.

9. In combination with a casing, rotary drilling apparatus including rotatable driving means extending longitudinally within the casing, and an underreaming drill having a heel portion and an offset lower portion, said drill being operatively connected to said driving means to be rotated thereby, said drill comprising a cutter rotatably mounted in the heel portion for orbital movement about the axis of the casing and a cutter rotatably mounted in the offset portion of the drill for rotation about a transverse axis.

In testimony whereof I affix my signature.

EDGAR E. GREVE.