H. R. HUGHES.

ROTARY DISK BORING DRILL.

APPLICATION FILED MAR. 19, 1914.

1,143,274.

Patented June 15, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

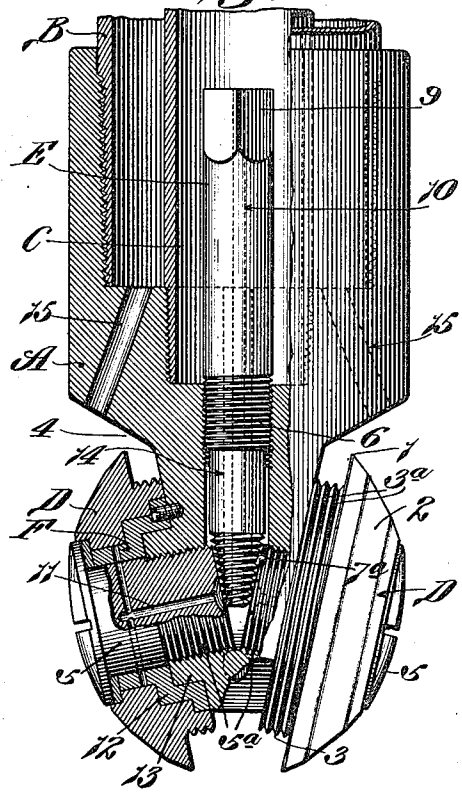


Fig. 4.

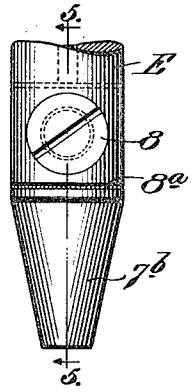


Fig. 3.

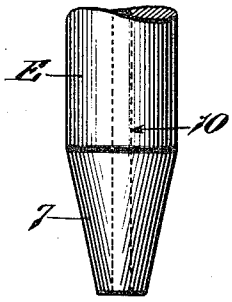


Fig. 2.

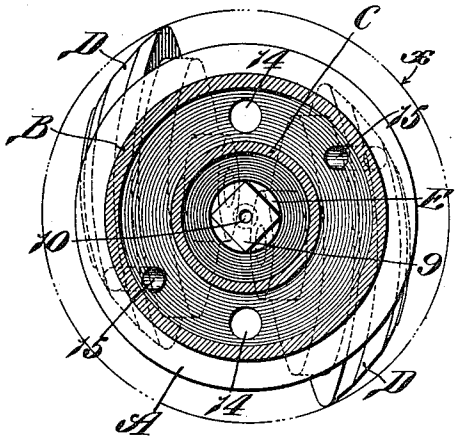
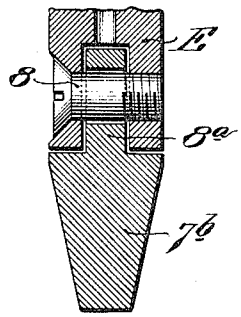


Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 6.

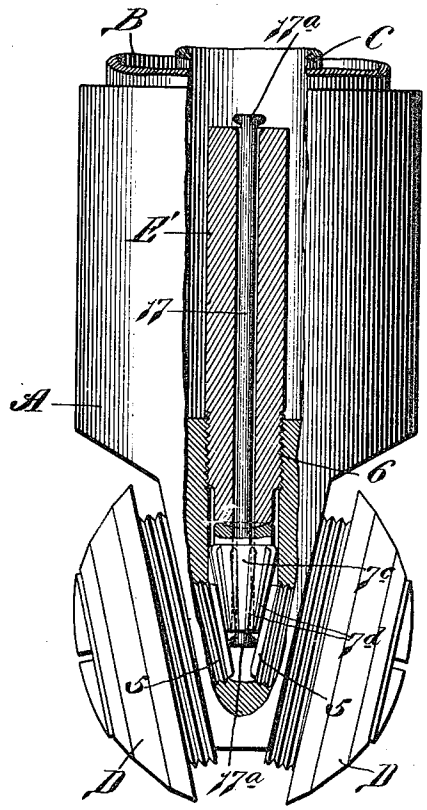
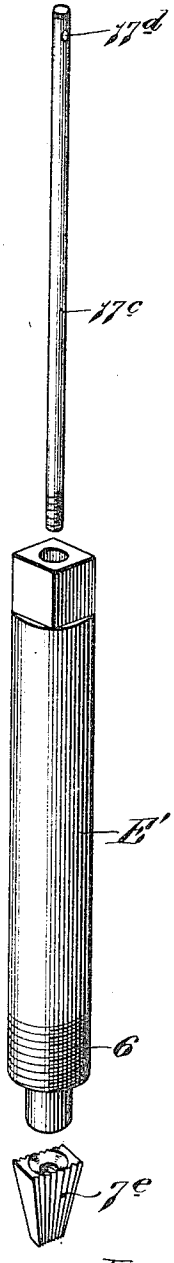


Fig. 7.



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UNITED STATES PATENT OFFICE

HOWARD R. HUGHES, OF HOUSTON, TEXAS, ASSIGNOR TO SHARP-HUGHES TOOL COMPANY, OF HOUSTON, TEXAS, A CORPORATION OF TEXAS.

ROTARY-DISK BORING-DRILL.

1,143,274. Specification of Letters Patent. Patented June 15, 1915.

Application filed March 19, 1914. Serial No. 825,797.

To all whom it may concern:

Be it known that I, HOWARD R. HUGHES, a citizen of the United States, residing at Houston, Texas, have invented a certain new and useful Improvement in Rotary-Disk Boring-Drills, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to rotary disk boring drills of the type illustrated in my pending application Serial No. 798,654, filed November 1, 1913, and has for one of its objects to provide novel means for securely locking in the head the spindles on which the cutters are rotatably mounted.

Another object is to provide a rotary disk drill in which the head is equipped with a plurality of sharp-edged cutters that have cutting surfaces which lie between the sharp edges of the cutters and the vertical axis of the drill head so as to destroy the core at the center of the bottom of the hole which lies inside of the zone described on the bottom of the hole by the sharp edges of the cutters.

Other objects and desirable features of my invention will be hereinafter pointed out.

Figure 1 of the drawings is a side elevational view, partly in vertical section, of a rotary disk boring drill constructed in accordance with my invention; Fig. 2 is a top plan view of same; Fig. 3 is a side elevational view of a portion of one form of locking-pin that may be used for locking the cutter spindles in the head; Fig. 4 is a similar view of another form of locking-pin that may be used for this purpose; Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 4; Fig. 6 is a side elevational view, partly broken away, of another form of my invention; and Fig. 7 is a perspective view of still another form.

Referring to the drawings which illustrate the preferred form of my invention, A designates the head of the drill which preferably consists of a block of metal provided at its upper end with an internally screw-threaded socket into which the lower end of the drill stem B is screwed. A second internally screw-threaded socket of smaller diameter is preferably formed in the head to receive a lubricant-holder C that contains a lubricant which is supplied to the bearings for the cutters of the drill.

The drill herein shown is provided with two substantially disk-shaped cutters D preferably of the design illustrated and described in my pending application Serial No. 820,670, filed Feb. 24, 1914, each of said cutters having a sharp cutting edge 1 that shears off the material from the side of the hole when the drill is in operation and a crushing surface 2 that lies beyond said cutting edge so as to crush and disintegrate the material at the bottom of the hole.

On the inner side of the cutter is a cylindrical cutting surface 3 of less diameter than the sharp edge 1 of the cutter which lies intermediate said sharp edge and the vertical center or axis of the drill head so that it will destroy the core at the center of the hole which lies inside of the zone described on the bottom of the hole by the sharp edge of the cutter.

The reduced portion 3 of the cutter can be provided with any suitable kind of cutting surface, that herein shown consisting of a cutting tooth 3^a that extends spirally around the portion 3 of the cutter, as shown in Fig. 1.

The cutters D are inclined in such a manner that the lower portions of same converge toward the longitudinal axis or center of the drill head, as shown in Fig. 1, and said cutters are offset slightly or set a trifle to one side of the center of the head, as shown in Fig. 2, so that the rear sides or edge portions of same will not drag against the side of the hole, indicated by the circle x in Fig. 2, when the drill is in operation.

Pockets 4 are preferably formed in the sides of the head, as shown in Fig. 1, so that portions of the head will project laterally over the cutters and thus prevent the sharp edges of the cutters from catching on projections in the hole when the drill is being removed from the hole.

In the preferred form of my invention as herein shown, the cutters D are rotatably mounted on spindles 5 that have threaded portions 5^a which are screwed into the head A of the drill, said spindles projecting laterally and downwardly from the head, and being offset slightly or set a trifle to one side of the longitudinal axis of the head, as shown in Fig. 2.

One feature of my present invention consists in means of novel construction for locking the spindles 5 in the head of the drill, and in the preferred embodiment of my invention, as herein shown, said means consists of a center locking-pin E in the head and a tapered member actuated by said pin that exerts pressure on the inner end portions of the spindles 5 so as to bind them so securely in the head that it will be impossible for said spindles to unscrew or work loose.

The locking-pin E is preferably provided with an externally screw-threaded portion 6 that screws into a center bore in the head A, and at the lower end of said pin is a tapered member or wedge 7, preferably of frusto-conical-shape, that becomes jammed tightly between the inner ends of the spindles 5 when the locking-pin E is tightened or screwed downwardly. This wedge or tapered member E can either consist of a separate part as shown in Figs. 6 and 7 against which the lower end of the locking-pin E bears, or the wedge can be formed integral with the locking-pin or connected to same by a fastening device.

In the form shown in Fig. 3 the wedge or tapered member 7 is formed integral with the locking-pin, and consists of a frusto-conical-shaped portion on the lower end of the locking-pin, the outer surface of the wedge either being smooth or provided with corrugations or projections such, for example, as a screw-thread 7^a, as shown in Fig. 1.

In the form shown in Figs. 4 and 5 the wedge 7^b is a separate member or part that is pivotally connected to the locking-pin E by means of a pintle 8 that passes transversely through a bifurcated portion of the locking-pin that embraces a shank or ear 8^a on the upper end of the wedge, thus permitting the wedge to swing transversely in one direction and assume an angular position with relation to the locking-pin. I also prefer to connect the wedge to the locking-pin in such a manner that there is sufficient play and lost motion between said parts to permit the wedge to swing laterally slightly in the opposite direction. The advantage of connecting the wedge to the locking-pin in this manner, or in such a way that it can assume an angular position with relation to the locking-pin, is that both spindles 5 will be securely locked in the head, even though one spindle is longer than the other or projects farther toward the longitudinal center of the head. This same result can be accomplished by the locking-pin E illustrated in Fig. 1 in view of the fact that the projections or spiral teeth 7^a on the wedge will cut into the inner end of the longer spindle when the locking-pin is tightened.

At the upper end of the locking-pin is a non-circular-shaped portion 9 that is adapted to be engaged by a socket wrench or other tool so as to screw the locking-pin into and out of operative position. The locking-pin E projects upwardly into the lubricant-holder C, and a duct 10 is preferably formed in said pin so as to permit the lubricant to flow through same to distributing lubricant ducts 11 in the spindles 5 that supply the lubricating medium to the bearings on which the cutters D rotate.

When the drill is provided with cutters D of the particular form herein shown, namely, cutters provided on their inner sides with reduced portions that destroy the core at the center of the hole, bushings F of bronze or other suitable material, are preferably mounted on the spindles 5 so as to provide an exceptionally large bearing area for each cutter, each of said bushings having a relatively large cylindrical-shaped bearing portion 12 that surrounds a boss or flange 13 on the head of the drill through which the spindle 5 passes. By constructing the drill in this manner I am able to use spindles that have comparatively long threaded portions that are surrounded by solid metal in the head, thus producing an exceptionally strong and serviceable drill; and another desirable feature of such a drill is that the cutters cut very close to the center of the hole and thus leave only a small core which will be crushed and disintegrated finely by the reduced portions 3 on the inner sides of the cutters.

The crushing surfaces 2 of the cutters can either be plain or toothed, and the reduced portions 3 of the cutters can be provided with any preferred type of cutting surface.

While I prefer to equip the drill with cutters of the particular type herein shown, namely, cutters having reduced portions on their inner sides that destroy the core, I wish it to be understood that my invention is not limited to a drill of this particular construction for one feature of my invention consists in providing the head of the drill with a device that is adapted to be forced into engagement with the cutter-supporting spindles so as to securely bind and lock said spindles in the head, irrespective of the particular type of cutters the spindles are provided with.

The water that is forced down through the drill stem to flush out the disintegrated material is preferably discharged from the head at a number of different points, and in such a manner that there is little tendency for the disintegrated material to adhere to the cutters or pack around the cutters. In the preferred embodiment of my invention as herein shown, the head is provided with two center water-holes 14 and two side water-holes 15. The center water-holes 14 dis-

charge jets of water at points in advance of the cutters and toward the center of the hole, and the two side water-holes 15 discharge jets of water downwardly onto the cutters toward the side wall of the hole and at points adjacent the rear edges of the cutters. Consequently, there is very little tendency for the disintegrated material to pack in the hole or cling to the cutters for the flushing water keeps the cutters clean and flushes out the disintegrated material that is removed from the side of the hole by the sharp edges of the cutters.

In operation, the sharp edges of the cutters D shear off the material from the side of the hole, and remain sharp by constantly rubbing against the side of the hole, and the portions 2 of the cutters crush and disintegrate the material at the bottom of the hole that lies outside of the point where the sharp edges of the cutters dig into the bottom of the hole, the crushing surfaces 2 of the cutters being so shaped that the bottom of the hole is of such form that there is little tendency for the drill to wabble in the hole. The small core that remains at the center of the bottom of the hole or which lies inside of the zone described on the bottom of the hole by the sharp edges of the cutters, is crushed and ground up progressively by the reduced portions 3 of the cutters which lie between the sharp edges of the cutters and the vertical axis or center of the drill head. The shearing strains on the spindles 5 are reduced to a minimum owing to the inclined position of said spindles and to the shape of the cutters D which are of such form that the weight imposed on the drill head tends to force the cutters inwardly against thrust-bearing surfaces on the bushings F. The drill comprises only a few rugged parts which are strong enough to successfully withstand the enormous strains which the drill is subjected to when the drill is in service; the cutters are so designed and are mounted on the head in such a manner that they do not drag against the side of the hole when the drill is in operation, and consequently will not wear out quickly; and the cutter-supporting spindles are so securely locked in the head that it is practically impossible for them to work loose and thus permit the cutters to become detached from the head.

In Fig. 6 I have illustrated another modification of my invention wherein the wedge or tapered member 7^c is provided with longitudinally extending teeth or corrugations 7^d that bite into the inner ends of the spindles on which the cutters are mounted. The center locking-pin E′ is screwed into the head so that the lower end of same will bear upon the upper end of the wedge 7^c and thus force said wedge tightly against the spindles when the locking-pin E′ is tightened. A coupling-pin 17 that extends longitudinally through the wedge 7^c and through the locking-pin E′ is provided at its upper and lower ends with heads 17^a so as to connect the wedge and locking-pin together and cause the wedge to be withdrawn from engagement with the spindles when the locking-pin E′ is loosened. If desired, the coupling-pin 17 could be screwed into the wedge 7^c, and the upper end of said coupling-pin formed plain or not provided with a head so as to permit the locking-pin E′ to be inserted and removed independently of the wedge, the wedge being inserted prior to the introduction of the locking-pin and removed after the locking-pin has been taken out of the head A of the drill, such a construction being shown in Fig. 7, or, if desired, the coupling-pin could be provided at its lower end with a head 17^a, as shown in Fig. 6, and a hole could be formed in the upper end of said coupling-pin as shown in Fig. 7 so as to permit a hook-shaped tool or instrument to be inserted in said hole to withdraw the wedge 7^c.

In the form of my invention shown in Fig. 7, the wedge or tapered member 7^e is rectangular-shaped in cross section so as to provide flat bearing surfaces on the wedge which bear squarely upon the inner ends of the spindles.

A pin 17^c is connected to the wedge 7^e in some suitable manner so as to enable said wedge to be positioned properly and removed, and the center locking-pin E′ is screwed into the head A of the drill and is provided with a longitudinally-extending bore through which the positioning pin 17^c passes, the lower end of the pin 17^c being preferably screwed into the wedge 7^e and the upper end of said pin 17^c being provided with a hole 17^b for receiving a hook-shaped tool or instrument so as to facilitate the removal of the wedge. In this form of my invention the wedge 7^e is first positioned and thereafter the center locking-pin E′ is screwed into the head A of the drill so as to force the wedge 7^e tightly against the inner ends of the spindles.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a rotary boring drill, a head, a plurality of spindles screwed into said head and provided with rotatable cutters, and a single locking device on the head that is adapted to be forced against the inner ends of said spindles so as to bind the spindles tightly in the head and thus prevents them from working loose.

2. A rotary boring drill provided with a head, a cutter-supporting spindle screwed into the head, and an adjustable locking device carried by the head and arranged adjacent the inner end of the spindle at an

angle to the direction the spindle extends, said locking device being adapted to be forced tightly against the inner end of the spindle so as to securely bind the spindle in the head and prevent it from working loose.

3. A rotary boring drill provided with a head, a cutter-supporting spindle screwed into said head, and an adjustable locking device arranged in the head at approximately right angles to the spindle and adapted to be pressed tightly against the inner end of the spindle so as to cause the coöperating screw threads on the spindle and head to bind and thus prevent the spindle from working loose.

4. A rotary boring drill comprising a head, a cutter-supporting spindle screwed into said head, and an adjustable locking wedge carried by said head that bears against the inner end of said spindle and thus binds it securely and prevents it from working loose.

5. A rotary boring drill comprising a head, a cutter-supporting spindle screwed into said head, a wedge carried by the head and arranged at an angle to said spindle so that it will bear against the inner end of said spindle, and means for forcing said wedge tightly against the spindle.

6. A rotary boring drill comprising a head, a cutter-supporting spindle screwed into said head, a screw-threaded locking-pin in said head, and a tapered device actuated by said locking-pin that bears against the inner end of said spindle and thus securely locks it in the head.

7. A rotary boring drill comprising a head, a plurality of cutter-supporting spindles that project outwardly from the center axis of the head, and a single locking device in the head that is adapted to be forced into engagement with the inner ends of said spindles so as to bind them in the head.

8. A rotary boring drill comprising a head, a plurality of spindles screwed into said head and projecting outwardly from the longitudinal axis of same, and a locking wedge in the head that is adapted to be forced into engagement with the inner ends of said spindles so as to bind them in the head.

9. A rotary boring drill comprising a head, a plurality of cutter-supporting spindles projecting outwardly from the longitudinal axis of the head, a tapered locking device at the center of the head that is interposed between the inner ends of said spindles, and means for forcing said device tightly between said spindles.

10. A rotary boring drill provided with a head, an inclined cutter-supporting spindle screwed into the head, and a locking device comprising a wedge that is adapted to be forced into engagement with the inner end of the spindle so as to exert pressure on the spindle in a direction parallel to its length and thus bind the spindle so securely in the head that it cannot unscrew or work loose.

11. A rotary boring drill comprising a head, inclined cutter-supporting spindles that project outwardly from the longitudinal center of the head, and an adjustable locking device in the head comprising a wedge that is interposed between the inner ends of said spindles and thus exerts sufficient pressure on same to prevent the spindles from working loose.

12. A rotary boring drill comprising a head, a plurality of inclined spindles screwed into the head and projecting outwardly from the center of the head, a locking-pin screwed into the head, and a tapered member adapted to be forced by said pin tightly against the inner ends of said spindles.

13. A rotary boring drill comprising a head, a plurality of downwardly inclined spindles that are screwed into the head and which project outwardly from the center of the head, a locking-wedge that presses against the inner ends of said spindles, and an actuating device for said wedge that is screwed into the head.

14. A rotary boring drill comprising a head, inclined cutter-supporting spindles screwed into said head and projecting outwardly therefrom, a locking-pin having a screw-threaded portion arranged in an internally screw-threaded bore in the head, and a tapered member actuated by said pin that presses against the inner ends of said spindles and thus securely binds them in the head when said pin is tightened.

15. A rotary boring drill comprising a head provided with a center bore, inclined cutter-supporting spindles screwed into said head and having their inner ends projecting into said bore, a locking-pin in said bore, and a tapered member actuated by said pin that becomes wedged tightly between the inner ends of said spindles when said pin is turned in one direction.

16. A rotary boring drill comprising a head provided with a center bore, inclined cutter-supporting spindles screwed into said head and having their inner ends projecting into said bore, a tapered member interposed between the inner ends of said spindles and pressing against same, and a locking-pin in said bore that actuates said tapered member and provided at its upper end with means for enabling it to be turned.

17. A rotary boring drill comprising a head, inclined cutter-supporting spindles screwed into said head and projecting outwardly from the center of the head, a wedge that engages the inner ends of said spindles and thus binds them in the head, and an actuating device for said wedge connected

thereto in such a manner that the wedge can assume an angular position with relation to said device.

18. A rotary boring drill comprising a head, inclined cutter-supporting spindles screwed into said head and projecting outwardly from the center of the head, a wedge that presses against the inner ends of said spindles and thus binds them in the head, and an actuating device for said wedge screwed into the head and pivotally connected to the wedge.

19. A rotary boring drill comprising a head provided with a center bore that has an internally screw-threaded portion, inclined cutter-supporting spindles screwed into the head and having their inner ends projecting into said bore, a locking-pin screwed into said bore, and an approximately frusto-conical-shaped member actuated by said pin that becomes wedged tightly against the inner ends of said spindles when said pin is tightened.

20. A rotary boring drill comprising a head provided with a center bore that has an internally screw-threaded portion, inclined cutter-supporting spindles screwed into the head and having their inner ends projecting into said bore, a locking-pin screwed into said bore, and a substantially frusto-conical-shaped wedge pivotally connected to said pin, and arranged between the inner ends of said spindles so that it will securely bind the spindles in the head when said pin is tightened.

21. A rotary boring drill comprising a head provided with a lubricant-holder, cutter-supporting spindles screwed into said head and provided with lubricating ducts, and a locking-pin for said spindles provided with a lubricating duct for conducting the lubricating medium from said holder to the ducts in said spindles.

22. A rotary boring drill comprising a head provided with a lubricant-holder, cutter-supporting spindles in said head provided with lubricating ducts, and a locking device for said spindles projecting upwardly into said lubricant-holder and provided with a duct which supplies the lubricant to the ducts in said spindles.

23. A rotary boring drill comprising a head provided with an internally screw-threaded socket for receiving a drill stem, a lubricant-holder on said head projecting upwardly into said drill stem, downwardly inclined cutter-supporting spindles screwed into said head and projecting outwardly from the center thereof, a locking-pin screwed into the head, and a tapered member actuated by said pin that bears against the inner ends of said spindles, said pin and spindles having lubricating ducts for receiving the lubricating medium in said holder.

24. A rotary boring drill comprising a head provided with sharp-edged disk-shaped cutters that are inclined in such a manner that the lower portions of same converge toward the longitudinal axis of the head, spindles for said cutters screwed into the head, and an adjustable tapered locking device in said head that bears against the inner ends of said spindles and thus prevents them from working loose.

25. A rotary boring drill comprising a head, a plurality of sharp-edged rotatable cutters arranged on said head in such a manner that the lower portions of same converge toward the longitudinal axis of the head, said cutters being so mounted that the forward edges of same rub against the side of the hole, supporting spindles for said cutters screwed into the head, and a single locking device for said spindles mounted in the head and bearing against the inner ends of same so as to bind them in the head.

26. A rotary boring drill consisting of a head provided with a plurality of sharp-edged cutters arranged in such a manner that they shear off the material at the side of the hole and dig into the bottom of the hole, reduced cutting portions on the inner sides of said cutters that destroy the core at the center of the hole which lies inside of the zone described on the bottom of the hole by the sharp edges of said cutters, supporting spindles for said cutters screwed into the head, and a locking device on the head that is wedged between the inner ends of said spindles and thus prevents them from working loose.

27. A rotary boring drill consisting of a head, and sharp-edged disk-shaped cutters rotatably mounted on said head and provided on their inner sides with reduced cutting portions that destroy the core at the center of the hole, said cutters being inclined in such a manner that the lower portions of same converge toward the longitudinal axis of the head.

28. A rotary boring drill provided with a sharp-edged rotatable cutter arranged in such a manner that the forward edge of same shears off the material from the side of the hole and the lower portion of same disintegrates the material at the bottom of the hole, and means for introducing jets of flushing water at a point in advance of the cutter and toward the center of the hole and also downwardly toward the side wall of the hole at a point adjacent the rear edge portion of the cutter.

29. A rotary boring drill provided with a sharp-edged rotatable cutter arranged in such a manner that the lower portion of same inclines inwardly toward the vertical axis of the head of the drill, the forward edge of said cutter shearing off the material from the side of the hole and the lower por-

tion of same disintegrating the material at the bottom of the hole, and means for introducing a jet of flushing water downwardly onto said cutter and also laterally away from the cutter and toward the side wall of the hole so as to prevent the disintegrated material from clinging to the cutter or from becoming packed in the hole around said cutter.

30. A rotary boring drill provided with approximately disk-shaped cutters that are inclined in such a manner that the lower portions of same converge toward the longitudinal axis of the drill, and means for introducing jets of water downwardly toward the bottom of the hole at points in advance of said cutters and also downwardly and laterally onto said cutters and toward the side wall of the hole.

31. A rotary boring drill comprising a head, sharp-edged cutters rotatably mounted on said head in an inclined position so that the lower portions of same converge toward the longitudinal axis of the drill head, center water-holes in the head which discharge jets of water at points between the cutters, and side water-holes formed in the head at such a downwardly inclined angle to the vertical axis of the head that jets of water will be discharged downwardly toward the side wall of the hole.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this tenth day of March 1914.

HOWARD R. HUGHES.

Witnesses:
E. E. WRIGHT,
W. E. RATLIFFE.