H. R. HUGHES.

CROSS ROLLER DRILL BIT.

APPLICATION FILED DEC. 27, 1919.

1,348,419. Patented Aug. 3, 1920.

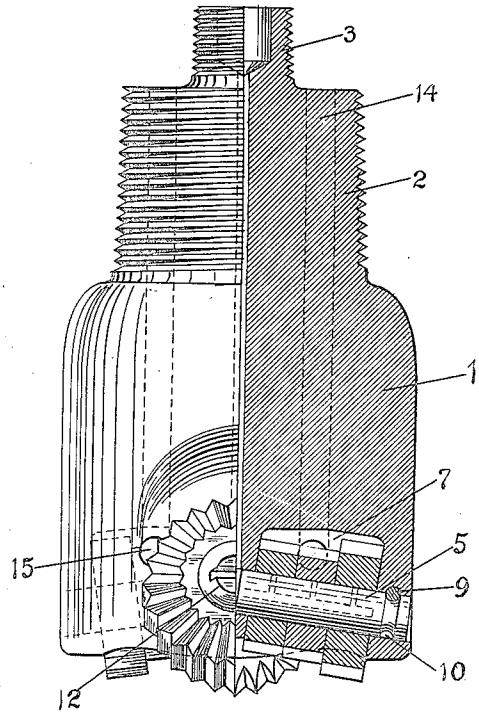


Fig. 1.

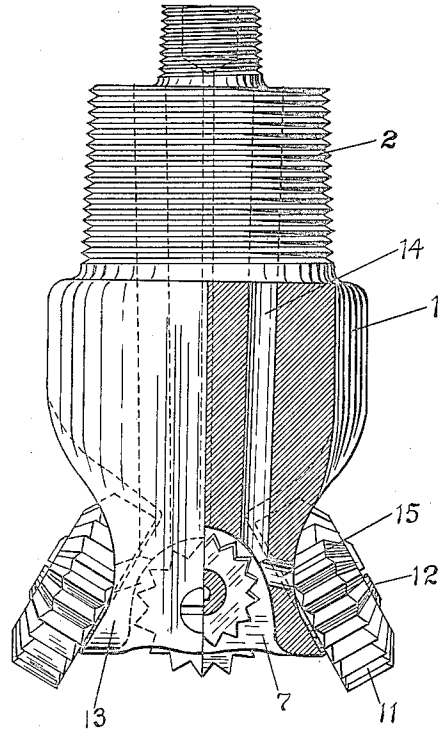


Fig. 3.

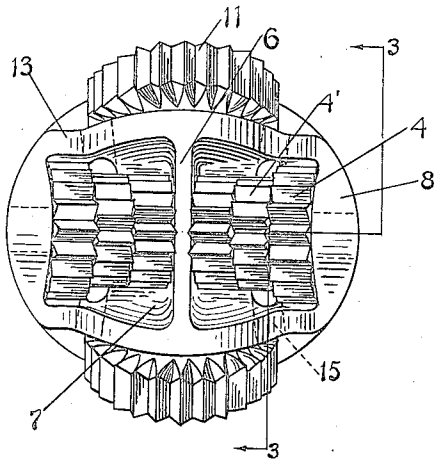


Fig. 2.

Howard R. Hughes, Inventor

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UNITED STATES PATENT OFFICE.

HOWARD R. HUGHES, OF HOUSTON, TEXAS.

CROSS-ROLLER DRILL-BIT.

1,348,419. Specification of Letters Patent. Patented Aug. 3, 1920.

Application filed December 27, 1919. Serial No. 347,752.

To all whom it may concern:

Be it known that I, HOWARD R. HUGHES, a citizen of the United States, residing at Houston, Harris county, Texas, have invented a certain new and useful Improvement in Cross-Roller Drill-Bits, 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.

My invention relates to an improvement in cross roller bits and has particular reference to the construction of the head in which the rotating cutters are mounted. The invention is an improvement on the structure shown and described in my copending application Serial No. 297,979, filed May 19, 1919, since become Patent No. 1,327,913, issued January 13, 1920.

The object of my invention is to so construct the walls surrounding the cutters in the lower end of the head that the cutters thereof will be protected and the head itself will be strengthened.

Another object is to provide a housing for the cutters which will surround them as closely as possible so that the flushing water will act more efficiently on the cutters to clear them of the disintegrated material cut by the bit.

Referring to the drawings forming a part of this specification and wherein like numerals of reference are applied to like parts in both the views,

Figure 1 is a side view partly in elevation and partly in central longitudinal section;

Fig. 2 is a bottom plan view of my improved bit showing the housing for the cross roller cutters; and

Fig. 3 is a side elevation partly in section on the line 3—3 of Fig. 2.

The tool constituting my invention comprises a head 1 approximately cylindrical in shape and having an upper shank 2 reduced in diameter and threaded for attachment to the drill stem, not shown. At the upper end of the shank 2 is a nipple 3 of smaller diameter furnishing an attachment to a lubricator, also not shown. On the lower end of the head 1 is mounted a series of cross roller cutters 4, 4′. The said cross roller cutters extend across the central lower portion of the head and act to roll upon the bottom of the hole and disintegrate the central portion thereof. These cutters are mounted on shafts 5 inclined downwardly from the central axis of the head, being supported at the inner ends on a web or partition 6 which serves to separate the housing into two chambers, 7, 7. The outer end of each shaft 5 is supported in a downwardly projecting arm 8 of the head. The cross roller cutters comprise two sets of three cutters each, the outer cutter 4 being larger in diameter than the two inner cutters in each set. The reduction in size of the cutters toward the central axis of the bit is for the purpose of obtaining a conical shaped bottom to the hole and also to allow the strengthening of the central support or web 6 of the cutters. The shaft 5 is a straight pin inserted from the outer face of the head and held in position by a locking pin 9 inserted into the side of the support 8 at right angles to the shaft, so as to fit within a groove 10 therein and prevent the removal of the shaft in an obvious manner.

On each side of the central cross roller cutters are mounted side cutters 11. These side cutters are mounted on axes arranged at approximately right angles to the shafts 5 of the cross rollers, the axes 12 on which they are mounted being inclined upwardly from the vertical axis of rotation of the head so as to incline the cutters outwardly at the lower end to cut a clearance for the bearing supports 8 for the cross roller cutters and to allow the free rotation of the bit within the hole. This type of cross roller bit is covered in my application previously mentioned and no claim is made herein to the general construction of this type of bit.

The improvement constituting this invention comprises a housing for the cross roller cutters. In previous constructions of this type of bit the cutters are mounted in as open a position as possible so that the material in the hole may find ready entrance into the slot in which the cross roller cutters are mounted. I find, however, that by extending the walls 13, which serve as a mounting for the shafts 12 of the side cutters, I will obtain a completely inclosed housing for the cross rollers. This housing, which I form so as to inclose the cross roller cutters as closely as possible, serves to protect the cutters from all sides, except the lower portion which acts upon the bottom of the hole. By thus extending the housing I also

strengthen the lower portion of the head of the bit. The outer support 8 is connected by means of this housing to the central web 6 thus preventing a tendency to spread the lower supports 8, upon which the cross rollers are mounted, and allow the shaft 5 to become loosened from its inner support. It also protects the cutters so that the pebbles and boulders which may be found in the bottom of the hole may not be caught at the side of the cutters and prevent their rotation. Furthermore, the flushing water acts more efficiently upon the cutting rollers. In this embodiment the flushing water is supplied to the chambers 7 by means of two channels 14 on each side of the head, these channels passing directly downward through the head and discharging at the sides of each of the chambers. Because of the manner in which the housing closely surrounds the cutters, the passage of water from the housing is constricted so as to be projected with some force against the cutting periphery of the cross rollers, thus keeping them cleared of detritus at all times. By confining the water closely in the chambers 7, however, there is a strong back pressure exerted on the pumps which I arrange to relieve by allowing an escape laterally of a small portion of the water by means of passages 15 leading from said chambers in a slightly downwardly inclined direction and discharging against the periphery of the side cutters 11. This provision performs two functions in that the back pressure in the drill stem is relieved and also the side cutters are flushed with water, thus carrying away material tending to adhere thereto. By discharging the water against the side cutters mounted in the open portion in which they are placed in my invention no nozzle effect is produced. But as two streams of water are directed against the peripheral teeth of each cutter, said cutters are maintained clear of disintegrated material, thus preventing their clogging.

The wall of the housing 13 closely surrounds the cross roller cutters in the manner described and therefore not only tends to strengthen the head and prevent the distortion thereof by the strains to which it is subjected, but also serves to protect the cross roller cutters and to so direct the flushing water against the cutters as to keep them from clogging.

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

1. In a rotary boring drill, a head, two sets of cross roller cutters on the forward end thereof, said cutters being mounted on shafts supported on a central reinforcing web at one end and on a forwardly extending arm at the other end, said cutters being closely housed by walls extending from said web to said support and inclosing said cutters on all but the cutting side thereof, side cutters on the side faces of said walls and water channels discharging through said head onto said cross roller cutters, said walls having openings to allow passage of water laterally from said cross roller cutters onto said side cutters.

2. In a rotary boring drill, a head, two sets of cross roller cutters mounted in pockets in the lower end thereof, the walls of said pockets closely housing said cutters on all sides, two side cutters mounted on the outer faces of said walls, flushing channels discharging into said pockets and lateral passages leading from said pockets against said side cutters.

In testimony whereof, I hereunto affix my signature, this the 22 day of December, A. D. 1919.

HOWARD R. HUGHES.