

H. R. HUGHES.
CROSS ROLLER BIT.
APPLICATION FILED MAR. 1, 1919.

1,320,394.

Patented Nov. 4, 1919.
2 SHEETS—SHEET 1.

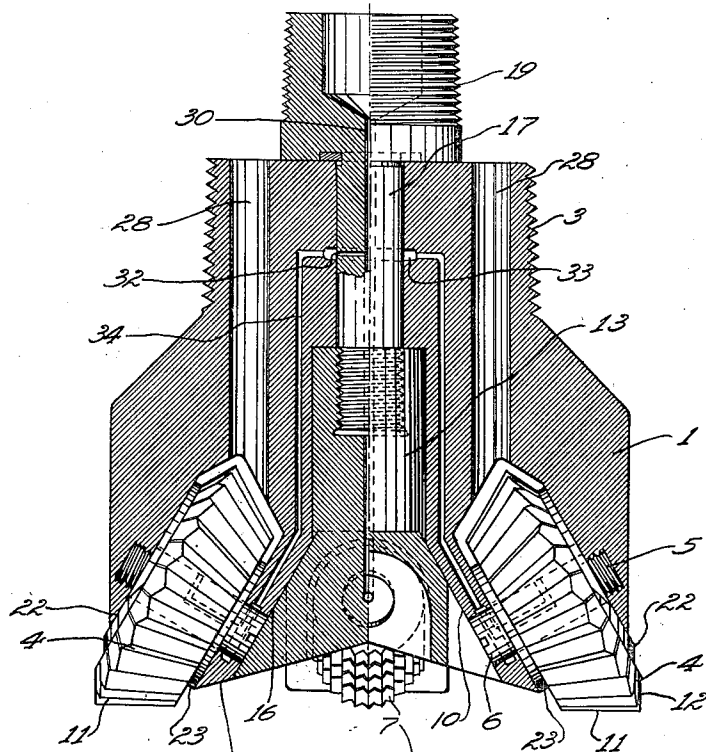


Fig. 1

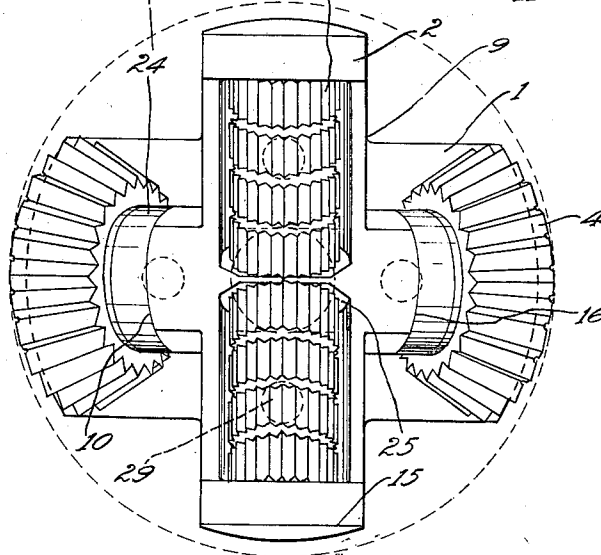


Fig. 2

HOWARD R. HUGHES, Inventor

By His Attorney *Jesse R. Stone*

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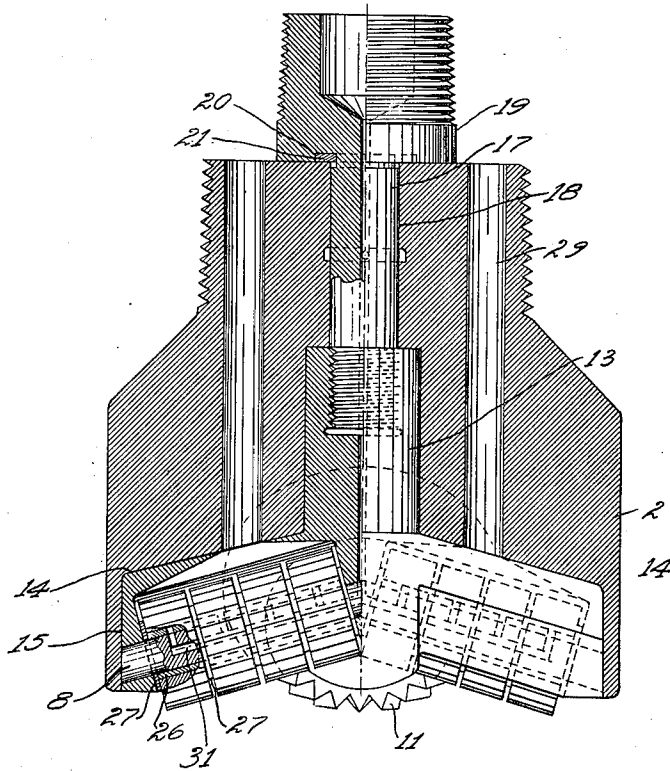


Fig. 3

HOWARD R. HUGHES, Inventor
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UNITED STATES PATENT OFFICE.

HOWARD R. HUGHES, OF HOUSTON, TEXAS.

CROSS-ROLLER BIT.

1,320,394.

Specification of Letters Patent.

Patented Nov. 4, 1919.

Application filed March 1, 1919. Serial No. 280,096.

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 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 improvements in rotary boring drills for use in drilling wells for water, oil or gas and has particular reference to drills of the so called cross roller type for use in hard formation. It constitutes an improvement on my prior Patent No. 1,119,164, issued December 1st, 1914.

One object of my invention is to provide a bit of the cross roller type in which the parts are fitted together in such manner that the pins or shafts upon which the cutters are mounted, will be retained in the head of the bit without the possibility of becoming detached and lost in the hole.

Another object is to so construct the head of the drill that the same may be quickly taken apart and repaired, when necessary, and to provide at the same time a structure which is strong and durable and able to withstand the strains to which a bit is subjected.

Other objects and advantages of my invention will appear in the more detailed description which follows, and will be set forth with more particularly in the claims.

Referring to the drawings wherein the preferred embodiment of my invention is illustrated, Figure 1, is a central longitudinal section, some of the parts being shown in elevation for greater clearness. Fig. 2 is a bottom plan view of the same and Fig. 3 is a section similar to that shown in Fig. 1, but taken at right angles to the section there shown.

Like numerals refer to like parts throughout the several views. The head of my improved bit is made up of a casting which is somewhat cross-shaped in plan view, as shown in Fig. 2, having two laterally projecting portions 1 on which the side cutters 4 are mounted and two laterally projecting portions 2 at right angles to the portions 1, the portion 2 furnishing a support for the cross roller cutters 7. The upper part of the head is reduced in diameter and cylindrical in shape and is threaded, as shown at 3, for attachment to a drill collar not shown.

On the lower portion of the head are the two side cutters 4 mounted in an inclined position on shafts 5. Said shafts 5 are threaded at the outer ends into the supporting sections 1 of the head and provided with flat heads 6, which, when in assembled position, are flush with the inner flat face 10 of the supporting sections 1, of the head. The cutters 4 are preferably frusto-conical in shape, so that the main cutting edge 11 will be approximately horizontal, when the bit is operating in the hole. The outer edge of the cutting periphery is beveled, as shown at 12, so as to present a broad cutting edge to the side of the hole and thus prevent a too rapid wearing of the disks at that point and serve to maintain the gage of the hole to greater advantage.

The two lateral bosses 2 of the head are recessed on the lower face thereof to receive the housings 14, 14 for the cross roller cutters 7. The housings 14, 14 are integral with an upper cylindrical, detachable post 13, which is adapted to fit within a cylindrical recess in the central axis of the head. As shown in Fig. 3, the lower housings of the central section, upon which the cross roller cutters are mounted, are formed to fit within the recess in the lower portion of the head adapted to receive the same. The two laterally projecting portions 14, 14, extend nearly to the outer end of the sections 2 and are provided with outer faces 15 which, when the parts are in operative position in the head, fit closely within the recesses in the lateral bosses 2. As shown in Figs. 1 and 2 the cross roller support is beveled outwardly in cross section and the recess in which it fits comprises an upwardly tapering chamber in the head. The housing has two lateral faces 16, adapted to contact with the inner faces 10 of the head, thus serving to retain in position the cutter shafts 6 upon which the side rollers are mounted.

The central retaining post 13 for the cross roller support is held in its operative position by means of a threaded bolt or post 17 which is adapted to fit within a cylindrical recess 18 bored centrally in the upper portion of the head. This bolt 17 is formed integral with the upper threaded nipple 19 to which is attached a lubricant container, not shown. The post 17 is threaded at its lower end for attachment to the upper end of the post 13, and, when screwed into tight adjustment, will serve to retain the cross roller

support firmly within the head. The lower face of the nipple 19 is provided with an annular recess 20, surrounding the upper portion of the bolt 17 and this recess is fitted with a compressible washer 21 which serves to prevent the entrance of water or grit around the upper end of the bolt.

The side cutters 4 are mounted in slots in the supporting bosses 1 of the head as shown in Fig. 1 and provided with non-friction outer washers 22 and similar inner washers 23 in the usual manner. The inner supporting portion of the slot, in which the cutters are mounted is rounded at 24, as shown in Fig. 2, to conform to the shape of the washer 23 on the lower face thereof and shaped on its inner face 10 to conform to the shape of the lateral beveled portion 16 of the cross roller support.

The cross roller cutters 7 are housed in semi-cylindrical recesses 25 in the lower face of the supporting sections 14. They are mounted upon supporting pins 8 which are inclined downwardly toward the outer end thereof. Upon each of the inclined pins I have mounted a plurality of cutters of which I have shown four in number, each of the cutters being independently rotatable and adapted to roll upon the bottom of the hole as the drill head is rotated. Each of the cutters is provided with a central bushing or journal 26, and the cutters are separated from each other, and from the sides of the recess in which they are mounted, by washers 27 in the usual manner.

The cutters are provided with a plentiful supply of flushing water which is pumped down through the drill stem to which the drill is attached and is projected through the two lateral channels 28 upon the side cutters 4 and two similar channels 29 upon the cross rollers, thereby serving to flush away the material disintegrated by the cutters and serving to carry the detritus in suspension up through the grooves or channels 9 provided in the sides of the head and outside the drill pipe to the surface of the ground.

Lubricant is supplied to the cutters through a central channel 30, passing downwardly from the lubricant container through the retaining bolt 17 and post 13 to the inner ends of the cutter shafts 8 on the cross rollers and through channels 31 in said shafts 8 and laterally branching ducts therefrom to each of the cutter bearings. The bearings of the side cutters 4 are lubricated through ducts 32, which branch off intermediate the length of the post or bolt 17. The lateral ducts 32 lead to an annular recess 33 around the said bolt and from this recess, the ducts 34 conduct the lubricant downwardly to the shafts 6 upon which the side cutters are mounted and the lubricant is supplied to the bearings of the said cutters through central

ducts in said pins similar to the structure shown and described in relation to the cross roller cutters 7.

In assembling the cutters within my improved bit, the central cross roller supporting section 2 is detached from the head by unscrewing the upper bolt 17 and thereby releasing the section 2. The side cutters may then be adjusted into position in the slots or recesses in the side of the head and the pins 5 threaded into place so that the heads 6 of the pins are flush with the inner face 10 of the central recess. The cross roller cutters 7 are then mounted within the recesses 25 in the lower face of the removable supporting section. In doing this the cutters are assembled in position and the pins 8 are inserted through the central bearing portion thereof from the outer end of the supporting section. When thus assembled, the post 13 is inserted upwardly within the head and is secured in rigid position therein by the bolt 17 threaded downwardly from the upper portion of the head. When thus secured it is obvious that the pins 8 cannot be removed until the post 13 is withdrawn from the head far enough for the pins 8 to be pulled outwardly past the lower contacting portion of the head. It is also obvious that while the removable section is in position, the pins 6 holding the side cutters in position cannot be removed or become accidentally loosened and detached.

A drill constructed in accordance with my invention will be easily assembled and disassembled and when adjusted in operative position, the pins upon which the cutters are mounted may not be easily removed, but will be retained against accidental loosening and loss of the parts in the hole as the drill operates.

Having thus described my invention the objects and advantages of which will be clear without further description, what I claim as new and desire to protect by Letters Patent is:

1. In a rotary boring drill a head, two inclined side cutters mounted on pins in the lower end thereof, a beveled recess in said head between the said side cutters, a detachable housing adapted to fit within said recess, two sets of inclined cutters mounted in said housing, bearing pins for said cutters said bearing pins being retained in position by contact with the wall of said recess.

2. In a rotary boring drill, a head, a recess in the lower end thereof, cutters on opposite sides of said head rotatable on pins inserted from said recess, and a central removable section in said recess adapted, when in position, to secure said pins against removal.

3. In a rotary boring drill, a head, two sets of cross rollers mounted in an inclined position upon a removable housing, the said

head being provided with a beveled recess in the lower end to receive said housing, said cross rollers being rotatable on pins held in place by the walls of said recess when said housing is fitted in said head.

4. In a rotary boring drill, a head, two disk-shaped side cutters mounted in the base thereof, said head being provided with a beveled recess in the said base, pins for said side cutters adapted to be inserted outwardly from said recess, a set of central cutters mounted in a housing adapted to fit in said recess and retain said pins in position.

5. In a rotary boring drill, the combination of a head recessed on the forward end, a housing in said recess, side cutters in said head and cross roller cutters in said housing, said side cutters and cross roller cutters being mounted on pins adapted to be retained in position by contact of said housing in said recess.

6. In a rotary boring drill, a head, a recess in the lower end thereof, cutters on opposite sides of said head rotatable on pins inserted from said recess, a central removable

section in said recess adapted, when in position, to secure said pins against removal, and cutters on said central section mounted on axes retained in position by the wall of said recess.

7. In a rotary boring drill, a head having a recess in the base thereof, a cutter housing adapted to fit therein, means to secure said housing comprising a post on said housing, and a threaded pin fitting in the upper end of said head and adapted for threaded attachment to said post, said pin being integral with a lubricator attachment.

8. In a rotary boring drill, a head, two inclined disk cutters on opposite sides thereof, a housing between said disks, said housing acting as a support for cross roller cutters and to retain the axes of said disk cutters in position, and cutters in said housing.

In testimony whereof, I hereunto affix my signature this the 26th day of February A. D. 1919.

HOWARD R. HUGHES.