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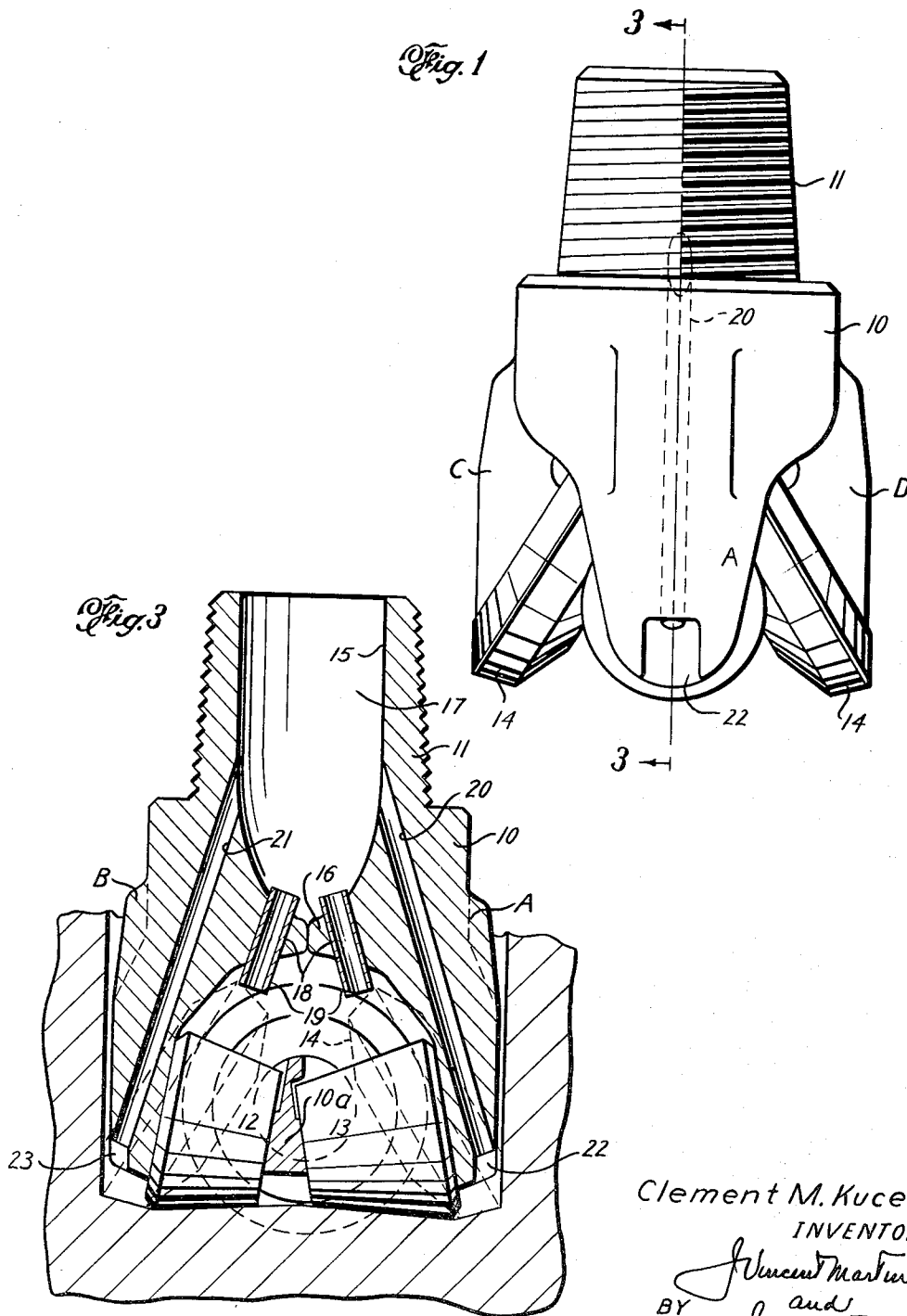
C. M. KUCERA

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DRILL BIT

Filed Oct. 22, 1948

2 Sheets-Sheet 1



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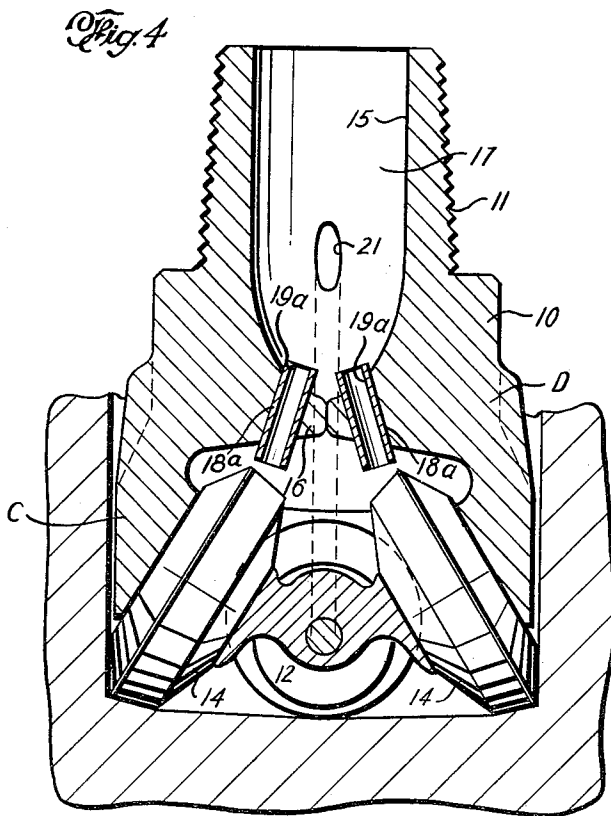
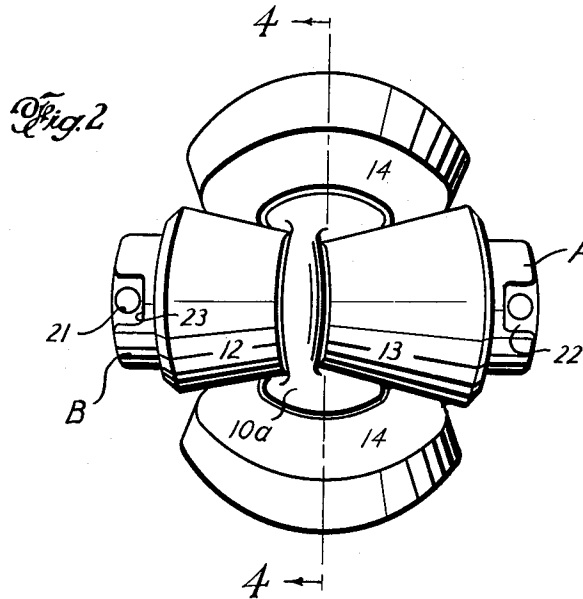
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DRILL BIT

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1 Claim. (Cl. 255—313)

This invention relates to new and useful improvements in drill bits.

The invention relates particularly to roller type rock bits and to improved means for directing the flow of drilling fluid through said bit during the drilling operation, whereby drilling efficiency of the bit is increased.

An important object of the invention is to provide an improved drill bit having means for directing the slush drilling fluid directly upon the bottom of the hole on the path traversed by the side roller cutters of the bit, whereby detritus resulting from the action of said side roller cutters is efficiently and immediately removed, which obviates previously cut formation being recut by said cutters and thereby permits a faster rate of penetration by the bit while reducing wear on the cutter teeth.

Another object of the invention is to provide an improved drill bit having drilling fluid passages therein, with the outlets of said passages being disposed between the side roller cutters of the bit so that the drilling fluid is discharged into contact with the bottom of the hole upon the path traversed by the cutters and functions, not only to prevent accumulation of previous cuttings between the side cutter teeth during the drilling operation, but also to maintain the bottom of hole traversed by said cutters as well as the side wall of the hole adjacent the path of the cutters clean and free from precut formation.

A further object of the invention is to provide a drill bit having improved circulating passages therein for directing the slush drilling fluid outwardly from the bit through outside nozzles which are disposed between the side roller cutters of said bit, whereby a washing action of the bottom of the hole on the path traversed by the side roller cutters is produced to facilitate more efficient drilling in softer formations.

Still another object of the invention is to provide an improved drill bit, of the character described, wherein the discharge outlets of the drilling fluid passages are disposed alternately with respect to the side roller cutters so that the drilling fluid is constantly discharged in advance of and also immediately behind each cutter as it traverses a circular path in the bottom of the hole during the drilling operation.

A still further object of the invention is to provide an improved drill bit of the four cutter type wherein the usual cross roller cutters are properly lubricated and washed by the slush drilling fluid and also wherein a portion of the drilling fluid is constantly discharged upon the path traversed by the side roller cutters.

The construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, wherein an example of the invention is shown, and wherein:

Figure 1 is an elevation of a drill bit constructed in accordance with the invention,

Figure 2 is a bottom view thereof,

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Figure 3 is a transverse, vertical, sectional view, taken on the line 3—3 of Figure 1, and showing the profile of the side roller cutters in a dotted line position which is 90° from their true radial location on the bit, and

Figure 4 is a transverse, vertical, sectional view, taken on the line 4—4 of Figure 2.

In the drawings, the numeral 10 designates a bit body having an upwardly extending threaded shank 11 whereby the bit body may be connected with the usual drill pipe. A pair of cutter supports or extensions A and B depend downwardly from the bit body and are disposed diametrically opposite each other and the usual cross-roller cutters 12 and 13 are arranged to be rotatably mounted on suitable shafts extending inwardly from said supports or extensions. As is usual practice, the rollers extend inwardly from the inner surfaces of the supports or extensions and a bridge member 10a supports the inner ends of the roller shafts. Side roller cutters 14 are mounted in diametrically opposed relationship to each other and are supported on depending bearing extensions or legs C and D. The bearing legs C and D are diametrically opposite each other in a vertical plane which is substantially 90° from the vertical plane in which the extensions or supports A and B are located. This locates the side roller cutters 180° apart, with each of the cross-roller cutters being spaced 90° around from said side cutters.

The shank 11 is formed with an axial bore, the lower end of which is closed by a transverse partition 16 and the area above said partition provides a drilling fluid accumulating chamber 17. The bit body 10 as well as its shank 11 and the extensions A, B, C and D have been illustrated as formed of four segments, which are suitably welded together; however, it is pointed out that the particular manner of forming the bit forms no part of the present invention.

For washing the cross-roller cutters to maintain the same clean during the drilling operation, inclined fluid passages 18 extend through the transverse partition 16 and may have suitable slush nozzles 19 (Figure 3) mounted therein; similar nozzles 19a extend through inclined openings 18a (Figure 4) in the partition 16 and have their lower ends disposed above the side roller cutters. Thus, drilling fluid from the chamber 17 is directed downwardly onto the teeth of the cross-roller as well as the side roller cutters. The nozzles 19 and 19a and said fluid function to wash away any formation which may become lodged between the teeth of said cutters, as well as to lubricate said cutters.

For co-acting with the side roller cutters 14 to increase the efficiency of the drilling operation, an elongated fluid passage 20 extends downwardly through the bit body and through the depending cross cutter support A. A similar passage 21 extends downwardly through the opposite cross cutter support B. The upper ends of the passages 20 and 21 communicate with the chamber 17 in the upper end of the bit body, whereby the drilling fluid from said chamber may flow downwardly through said passages.

Adjacent the lower end of the passage 20, the extension or support A is formed with a recess or cavity 22 and adjacent the outlet or discharge end of the passage 21, the opposite extension or support B is provided with a similar cavity 23. These cavities or recesses are provided for the purpose of preventing the lower end of each passage from contacting the formation to thereby prevent said passages from becoming plugged. As is clearly shown in Figure 3, the inclination of the passages 20 and 21, together with the location of their outlet ends, is such that the slush drilling fluid which is ejected therefrom is directed into contact with the bottom of the hole being drilled in the path traversed by the side roller cutters 14.

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Because the passages 20 and 21 are formed in the supports or extensions A and B, said passages are located in a position 90° around with respect to the point of contact made by the side roller cutters with the bottom of the hole. Therefore, the fluid ejected or discharged through the passages 20 and 21, is discharged at a point between the side roller cutters. As the drill bit is rotated, each cutter 14 will traverse a circular path in the bottom of the hole, and the discharging drilling fluid will be ejected at a point between said cutters. Therefore, a constant stream of drilling fluid is discharged in advance of and also behind each side roller cutter 14. With this arrangement, the chips or cuttings that are removed from the formation by the cutting teeth of each side cutter 14, are washed out of the path of the following or trailing side roller cutter with the result that any of the previously cut formation is not re-cut. The entire section of the bottom of the hole which is cut by the side cutters is kept clean and free of detritus with the result that the bit may penetrate the formation at a faster rate. Also, by maintaining the bottom of the hole clean, accumulation of previous cuttings between the teeth of the side cutters is prevented during the drilling operation and the life of the cutter teeth is thereby increased. Because the fluid is discharged into the bottom of the hole in the path traversed by the side cutters and is directed toward the outer periphery of the path through which said cutters travel, the circulation not only maintains the bottom of the hole in a clean condition but also cleans the side wall of said hole adjacent the path of travel of the side cutters. This facilitates maintaining the hole to proper gage.

The fluid which discharges from the lower end of the passages 20 and 21 is ejected forcibly into contact with the bottom of the hole and in the softer formations will actually function to assist in removing the formations during the drilling operation. Also, because of the location or point of ejection or discharge of the fluid from the passages 20 and 21, the bearings of the cross-roller cutters 12 and 13 are maintained cool and constantly lubricated.

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Having described the invention, I claim:

A drill bit including, a bit body having depending cutter supports disposed substantially opposite each other, cross roller cutters mounted on said supports, side roller cutters mounted on the bit body, said cutter supports having substantially straight drilling fluid passages extending therethrough with the discharge end of each passage being disposed to discharge drilling fluid downwardly substantially mid-way between said side roller cutters and in substantially a vertical line directly onto the circular path traversed by the side roller cutters during the drilling operation, the outer surface of each of said supports being substantially vertical at the lower end thereof, and each of said supports having a lateral inwardly extending recess in the lower end of the vertical outer surface which communicates with the discharge end of the fluid passage in each support, whereby said discharge end is prevented from becoming plugged by the formation, the discharge end of each fluid passage being disposed in close proximity to the bottom of the bore so that fluid therefrom is discharged onto the bottom of the hole with a jetting action and without any material washing of the side wall of said hole.

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