

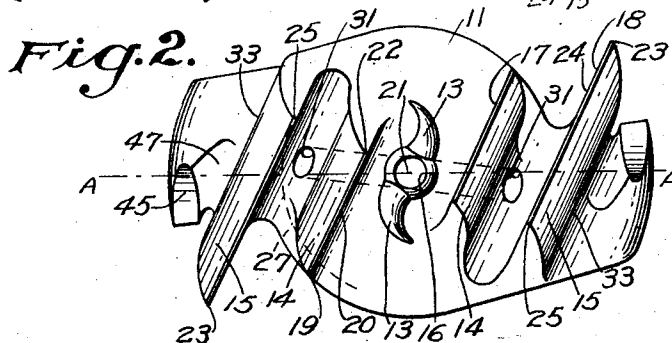
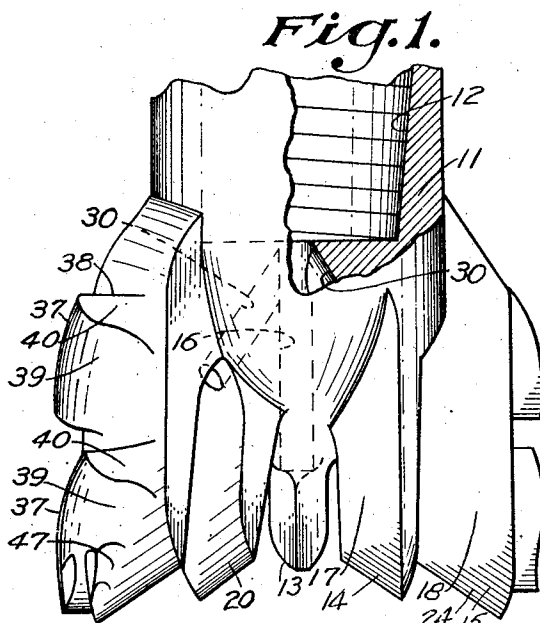
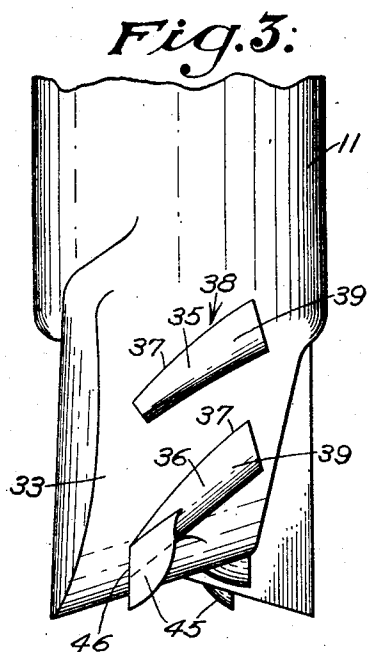
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ROTARY DRILL BIT

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ROTARY DRILL BIT

Application filed June 29, 1929. Serial No. 374,748.

This invention is a continuation in part of my application, Serial No. 340,725, filed February 18, 1929, for Bit having tangential blade, and relates to rotary drilling bits of the character employed in the drilling of wells by the rotary system.

In the present practice of the rotary method of well drilling, a tool is rotated in the hole by means of a string of drill pipe which extends from the tool in upward direction through the upper portion of the hole and is engaged for purpose of rotation by a rotary table. Rotary mud is pumped down through the drill pipe and is discharged through openings in or near the drill bit, this mud serving to support the walls of the hole and carry out the cuttings which have been produced by the drill bit.

In the drilling of a well, various substances must be penetrated, among which are shale, rock, and gumbo. The requirements of a drill bit vary with the character of the material being penetrated; for instance, where the bit is employed to penetrate hard substances, such as rock, it must be capable of withstanding severe abrasive action, but where soft materials are being penetrated an essential requirement of the drill bit is that it will not become clogged or that the materials will not ball up thereon in a manner to slow down the cutting action of the bit. In penetrating the soft materials which are cohesive in nature, such as gumbo, the ordinary types of rotary bits will become clogged so that the progress of the drilling operation is seriously reduced.

An object of my invention is to provide a bit having a total length of cutting edges much greater than the diameter of the hole being drilled and to so place these cutting edges that they will effectively operate against the formation to be penetrated, thus increasing the useful life of the drill bit and making it possible to operate the bit within a hole for a maximum period of time before it becomes necessary to pull the drilling string for the purpose of redressing or replacing the bit.

It is also an object of the invention to provide a bit of the above character having the

blades thereof so positioned that they will naturally be self-clearing in their action so as to minimize the possibility of clogging to the extent that the cutting action of the individual blades will be interfered with, and it is a further object of the invention to so place the blades of the bit that the cutting action thereof will be one of slicing rather than of scraping, as occurs in the use of the fish-tail type of bit.

A further object of the invention is to provide a rotary bit having reamer blades so formed that a relatively long cutting edge is presented in lateral direction, so that the reduction in diameter of the drill bit due to wear will be thereby minimized, and to so construct and place these reaming blades that they will be self-clearing and will therefore not gum up during drilling operations.

In my previous form of drill bit having downwardly directed cutting blades placed so as to operate with a slicing action, vertical reaming edges or blades are employed. Although these previous bits prove very satisfactory in that their rate of penetration is quite high as compared to other types of bits with which I have had experience, there is a tendency for the removed materials to clog or pack on the forward faces of the reaming blades with detrimental effect.

In my new construction the reaming blades operate with a slicing action, and due to this slicing action are kept clear from the accumulation of cuttings. Also in my new construction the amount of cutting edge presented to the side walls of the hole is materially increased relative to the vertical height of wall surface operated on by such reaming blades, with the result that the gauge of the drill bit is maintained for a greater period of time.

It is an object of the invention to provide a bit having very long cutting edges over which the wear produced in the cutting operation is distributed, these cutting edges being preferably faced or dressed with a hard alloy or being set with diamond-like material such as tungsten carbide.

Other objects and advantages of the in-

vention will appear in the following part of the specification.

Referring to the drawing which is for illustrative purposes only,

Fig. 1 is a front elevation of a rotary bit embodying the invention.

Fig. 2 is a bottom view of the bit shown in Fig. 1.

Fig. 3 is a side elevation corresponding to Fig. 1.

In the embodiment of my invention shown in the drawing, a body 11 is provided having means such as a threaded opening 12 whereby the body 11 may be secured to the lower end of a drilling shaft which is customarily formed by securing lengths of drill pipe together. Projecting downwardly from the lower part of the body 11 are central drilling blades 13, intermediate drilling blades 14, and outer drilling blades 15. These drilling blades are aligned with respect to a vertical plane represented by the horizontal center line A—A of Fig. 2.

As further shown in Fig. 2, the central blades 13 are forwardly curved with respect to their direction of movement when the drilling bit is rotated and are spaced on opposite sides of a vertical duct 16 which extends through the body 11 to the threaded opening 12 so as to receive drilling mud or other liquid pumped down through the string of drill pipe, to the lower end of which the bit is secured.

The intermediate blades 14 and the outer blades 15 are so disposed that their respective inner faces 17 and 18 slope outwardly with reference to the diametral center line A—A, with the result that forward ends 19 of cutting edges 20 provided by the intermediate blades 14 are disposed at radial distance from the center of rotation 21, Fig. 2, greater than the radial distance of the rearward ends 22 of the cutting edges 20 from the center of rotation 21, and forward ends 23 of cutting edges 24 provided by the outer blades 15 will be at greater radial distance from the center of rotation than rear ends 25 thereof.

The cutting edges 20 and 24 of the intermediate and outer blades 14 and 15 are disposed at an angle relative to their direction of movement, and, being so disposed, each traverses a circular area of considerably less width than the length of the blade which makes cutting engagement in such circular area.

As shown in Figs. 1 and 3, the cutting edges 20 and 24 slope downwardly from their rear ends 22 and 25 toward their forward ends 19 and 23.

An additional feature of the present construction is the placing of the forward ends 19 of the intermediate blades 14 at greater distance from the center of rotation 21 than the rearward ends 25 of the outer blades 15, as will be perceived from reference to the dotted line 27, Fig. 2, which represents an arc

in the circular line of movement of the inner end 25 of one of the outer blades 15.

Besides having a slicing action, the intermediate blades 14 are so placed relative to the inner blades 13 and the outer blades 15 that the circular areas traveled by each of the blades will overlap; therefore a cutting action will be performed on the entire bottom face of the hole being drilled. In addition to the central duct 16, lateral diagonal ducts 30 may be formed so as to communicate at openings 31 with the spaces between the intermediate blades 14 and outer blades 15.

The slicing action of the cutting edges 20 and 24 produces a rearward and inward movement of the cuttings along the inner faces 17 and 18 of the cutting blades 14 and 15, with the result that the cuttings do not remain stationary with respect to the inner faces of the blades but are caused to move therealong and to be discharged from the spaces between the cutting blades; consequently, clogging of the bit does not ordinarily occur even in operations in very sticky substances, such as gumbo.

On the outer diagonal faces 33 of the outer cutting blades 15 upper and lower reaming blades 35 and 36 are formed, each of these blades being provided with an upwardly and forwardly directed helical cutting edge 37 existing at the outer extremity of a forward helical face 38. From the helical cutting edges 37 lower faces 39 of the reaming blades 35 and 36 slope inwardly to merge with the outer faces 33 of the outer cutting blades 15. The general cross sectional shape of the reaming blades 35 and 36 may be perceived from viewing the ends 40 thereof in Fig. 1. The cutting edges 37 of the reaming blades 35 and 36, which are preferably set with hard alloy, travel through circular paths around the axis of rotation 21 and operate to remove materials from the side walls of the hole being drilled.

The cutting edges 37 are disposed angularly relative to their horizontal direction of movement when the bit is in rotation and perform an upwardly slicing action in accomplishing the cutting away of the cylindrical side walls, this slicing action causing the cuttings to move rearwardly and upwardly along the upper and forward helical faces 38 of the reamer blades 35 and 36, producing a constant removal or clearing of the cuttings from the reaming blades and preventing the clogging of materials against the front faces of the reaming blades as occurs where reaming blades are placed in vertical direction. It will be perceived that each cutting edge 37 is of a length which is considerably greater than the vertical dimension or height of the circular path traversed by such cutting edge during rotation of the bit, and that therefore the wear on the cutting edge resulting from its engage-

ment with the side walls of the hole is distributed over a substantially greater extent of cutting edge than where cutting edges are placed in perpendicular position relative to their direction of movement.

At the lower end of each lower reaming blade 36 I form a downwardly projecting advance reaming tooth 45 which may have a substantially vertical front face 46 and which is preferably separated from the outer face 33 of its cooperating cutting blade 15 by a groove or channel 47.

In the construction of the reaming blades I prefer that they shall be positioned substantially as shown so that the advance cutting teeth 45 will be near to the cutting plane of the cutting blades 14 and 15. These advance reaming teeth 45 are built up with hard alloy which may include calcium carbide and thus are capable of standing up under very hard usage. They are also of such form that they may be repeatedly built up, it being understood also that in the use of the rotary bit all of the cutting edges may be renewed by welding on metal to replace that which has been worn away during the drilling operation.

In the use of a bit of the character previously described, a rapid rate of drilling is maintained for the reason that the cutting edges are kept free from accumulation of cuttings, for the reason that the cutting action is one of slicing rather than of scraping, and for the reason that the wear resulting from the cutting operation is distributed over a relatively long cutting edge.

I have herein shown my invention in simple and operative form, but it is recognized that certain parts or elements thereof are representative of other parts, elements, or mechanisms which may be employed in substantially the same manner to accomplish substantially the same results; therefore, it is to be understood that the invention shall not be limited to the details disclosed but shall have the scope of the following claim.

I claim as my invention:

A bit of the character described, including: a body adapted for rotation on the end of a string of drill pipe, said body having a vertical duct extending through the center thereof; a plurality of central blade members projecting downwardly from said body, said central blade members having inner faces parallel with the cylindrical wall of said vertical duct; intermediate and outer blade members projecting downwardly from said body, the cutting edges of said intermediate and outer blade members being directed laterally at acute angles relative to their respective lines of movement when said bit is rotated; a set of reaming blades projecting laterally from said outer blade members, each set consisting of a plurality of helically disposed blade segments placed in upward pro-

gression; and an advance reaming tooth projecting downwardly from the lowermost blade of each set of reaming blades.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 21st day of June, 1929.

JESSE C. REESE.

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