

Feb. 29, 1944.

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2,342,931

DRAG BIT

Filed July 13, 1942

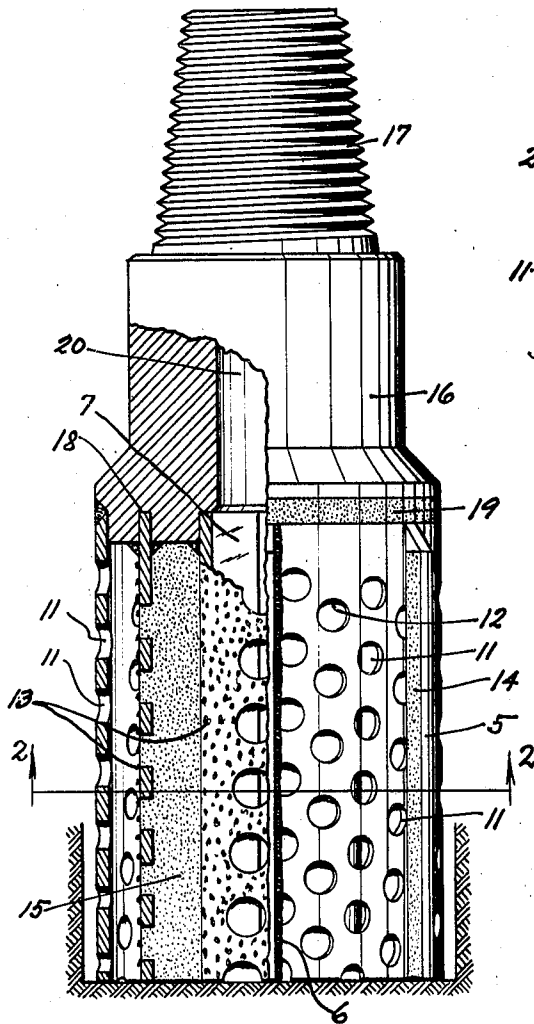


Fig. 1.

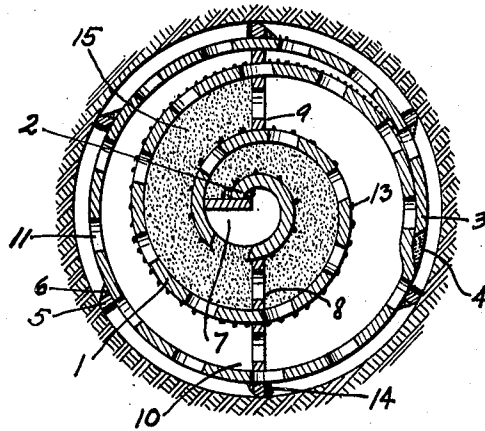


Fig. 2.

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UNITED STATES PATENT OFFICE

2,342,931

DRAG BIT

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Application July 13, 1942, Serial No. 450,651

3 Claims. (Cl. 255—61)

This invention relates to drill bits and has for its general object the provision of a drill bit which will possess the advantages of a shot drill bit or a drag bit but which will, however, not possess certain disadvantages inherent in shot bits and drag bits.

In certain hard formations a shot drill will operate very efficiently to drill a hole at a rapid rate. The action of a shot drill is essentially that of a drag bit. However, in the operation of a shot drill, chilled shot are fed into the hole to be broken up in the action of the drill and embedded in a soft iron head, and the cutting action is obtained by virtue of this embedded fragmented shot.

With a shot drill, little circulation can be carried out, or the shot fragments will be washed from the bottom. Also, when a shot drill encounters soft formation, the shot will tend to be embedded in the formation instead of in the soft iron head of the bit, and only a relatively smooth ring is then presented to the formation. The inefficiency of such a ring for drilling purposes will be apparent.

It is, therefore, a more specific object of this invention to provide a drill bit which will have a drilling action very similar to that of a shot drill but in which the necessity of feeding chilled shot into the hole to be broken up and imbedded in a soft iron head will be eliminated. Instead, it is an object of the present invention to provide a structure in which the equivalent of the chilled shot fragments is applied to the bit head as a part of the bit and will progressively come into cutting engagement as the bit wears down.

Another object of this invention is to provide a bit of the character referred to which will be capable of carrying full circulation of drilling fluid during the drilling operation without impairing the drilling action of the bit.

Another object of this invention is to provide a drill bit of the character referred to which will present a multiple of cutting teeth to a soft formation whenever such a formation is encountered and will thus serve to drill rapidly and efficiently in soft formations.

Another object of this invention is to provide a drill bit having in general the drilling action of a drag bit, but in which the drilling blade is presented not at substantially right angles to its direction of movement into the formation but at an acute angle with respect to its direction of movement so as to more efficiently break up and remove the formation.

Another object of this invention is to provide

a drill bit of the character referred to in which the cutting edge presented to the formation will be at all times one which is provided with a hard surfacing material.

5 Other objects and advantages of this invention will be apparent from the following description taken in connection with the accompanying drawing, in which one embodiment thereof is illustrated by way of example.

10 In the drawing:

Fig. 1 represents a view partly in side elevation and partly in longitudinal cross section through a bit constructed in accordance with this invention.

15 Fig. 2 represents a horizontal cross section through the lower or drilling blade portion of the same bit.

20 With reference more particularly to the drawing, the drilling blade or cutting portion of the bit illustrated in the drawing is made up of a plate or sheet of metal 1 wound in substantially spiral form and having its inner edge 2 disposed closely adjacent to the axis of rotation of the bit. Its outer edge 3 is closed against an adjacent convolution of the plate and welded thereto as indicated at 4 to form a cylindrical outer surface. At spaced intervals about this cylindrical outer surface, there are welded or otherwise suitably secured to the plate at circumferentially spaced intervals, a plurality of reaming blades 5 extending longitudinally of the bit. These reaming blades are illustrated as being welded to the exterior surface of the drilling plate as illustrated at 6.

35 The inner end of the plate 1 is welded to a spacer 7, which extends at substantially right angles to the plate and approximately along a radius to the next convolution of the plate so as to space the inner end definitely from the next adjacent convolution of the plate. Likewise, spacers 8, 9 and 10 extending longitudinally of the drill bit between adjacent convolutions of the plate may be employed for the purpose of properly spacing the respective convolutions.

45 The plate itself is formed substantially throughout its extent with a plurality of holes or openings 11, which may be circular as illustrated or of any other convenient shape, these holes being arranged in rows which are disposed at slight angles with respect to both the vertical and horizontal lines when the bit is in use, this arrangement being for a purpose presently to be described. Each of these holes or openings is also formed on its upper edge with hard surfacing material 12 so that when the plate wears away

and this upper edge of each opening in turn comes in contact with the formation, it will serve as a tooth with a hard surface thereon to dig into the formation.

Also, on the exterior surface of the plate 1 throughout the spiral portion thereof, the plate is provided with embedded fragments 13 of hard surfacing material. It is contemplated that these embedded fragments will be disposed throughout the entire length of the plate from top to bottom and throughout the entire length of the spirally arranged portion of the plate from the inner edge to the point at which the weld 4 is made. However, it will be understood that those portions of the plate which are most remote from the axis of rotation of the bit are called upon to cut a greater amount of material from the bottom of the hole than those portions of the plate which are most closely adjacent the center of the bit, and, for this reason, more hard surfacing material is applied to the outer portion of the spiral plate than to the innermost portion thereof, the concentration of hard surfacing material being graduated between these extreme inner and outer portions. Also, on the leading surface of each of the reaming blades 5 there is embedded hard surfacing material 14. All of this hard surfacing material may be of any well known type, but preferably is of a type similar to the widely-employed crushed tungsten carbide, and is preferably embedded in the metal of the plate 1 or the blade 5 itself.

In order to make it possible to pump drilling fluid down through the drilling bit, the spaces between certain of the innermost convolutions of the spiral plate are filled with some material of a friable nature, such as for example pumice stone with a suitable binder, as indicated at 15. This filler material will be retained in position by being interlocked through the perforated holes in the bit, but will crumble away on contacting the formation and by fluid action through the discharge end of the central conduit where restricted discharge area will increase the velocity of the drilling fluid. It will be seen, however, that this drilling fluid may pass down through the central opening within the innermost convolution of the spiral plate and that it will be confined to this passageway by the pumice stone or other material just referred to. Thus the drilling fluid will be forced to the bottom of the drill and will not be allowed to pass out laterally through the convolutions of the plate and through the openings 11 therein.

The drilling member which has been described is preferably carried on the lower end of a bit head 16, having a threaded shank 17 adapted to be connected to a drill stem in the usual manner. This head 16 is adapted to receive the upper end of the plate 1 and to be secured thereto in any desirable manner. As illustrated, however, it is preferable that the various turns or convolutions of the spiral be accurately spaced with respect to each other, and to this end the lower surface of the head 16 is provided with a spiral groove of such a nature as to just receive the upper spiral end of the plate 1. Such a groove is indicated at 18. After it has been assembled with respect to the head, the plate 1 may be welded to the head as shown at 19, both along the upper edge of the outermost turn of this plate and along each of the spiral convolutions thereof.

It is noted that the head 16 has a central passageway 20 therethrough adapted to communi-

cate at its upper end with the interior of a drill stem in the usual manner and to communicate at its lower end with the central passageway through the spiral bit and within the body of friable material 15 to the bottom or drilling end of the drill bit.

From the foregoing, it will be seen that this drill bit will be attached to a drill stem in the usual manner and lowered into a well, whereupon it will be rotated to produce the drilling action. During such rotation, the drilling fluid will be pumped down through the drill stem, through the passage 20, and through the central passageway in the drill bit.

In a conventional drag bit, it will be appreciated that the blades radiate in a substantially radial direction from a common center and when the bit is rotated they meet the formation at substantially right angles to remove the material from the formation by a straight shearing action. The blade of the spiral bit which has been described above engages the formation at a very acute angle and as it is rotated it tends to produce a wedging action on the formation with pressure increasing at an acute angle as the bit is turned. The outside circumference of the spiral blade also is the area always in contact with the formation and this is the one on which hard surface metal is applied in addition to the upper area of the perforated holes. As the blade travels on the formation, the velocity with which any given point moves over the formation varies in direct proportion to its distance from the center of rotation. Thus, those parts most remote from the center of rotation will receive the greatest wear, and in order to counteract this, the density of the application of hard surface material is increased as the distance from the center of rotation increases so that a consistent cutting action and relatively even wear of the bit over the entire area of the hole will be obtained.

It will be appreciated that many and various changes may be made in the construction and arrangement of parts of the bit without departing from the spirit or scope of this invention. It will also be appreciated that different forms of bits not adapted to cut the entire bottom of the hole may be devised employing this invention. It will be apparent, however, that by the drilling bit described there has been provided a device capable of carrying out and accomplishing all of the objects and advantages sought by this invention.

Having described my invention, I claim:

1. A drill bit comprising a spirally wound plate having one end formed with a cutting edge, and at least one convolution of said plate having the spaces between it and the next convolution filled with a friable material, but with the central portion of said spiral left open to form a continuous passageway throughout the length of the drill bit.

2. A drill bit comprising a spirally wound plate having one end formed with a cutting edge, a friable material filling the space between two adjacent convolutions of said bit for a distance of at least 360 degrees and leaving an open space at the center of said spiral to provide a continuous passageway from the upper to the lower end thereof, and a solid head secured to the upper end of said spiral plate and having an opening therein in communication with the passageway to said spirally wound plate, said solid head being adapted for connection with the drill stem, whereby it may be rotated.

3. A drill bit comprising a spirally wound plate,

the outermost turn thereof being closed to form a cylindrical exterior, and one end being formed with a cutting edge, said plate having a plurality of openings therein at spaced points throughout its extent and hard surfacing material on the upper edges of each of said openings and on the exterior surface of the plate forming said spiral, a plurality of reaming blades secured to the outer convolution of the spirally wound plate to cut the gauge of the hole, and a friable filling material between two of the adja-

cent convolutions of said spirally wound plate and extending at least 360 degrees to form a closed passageway through the central portion of such spirally wound plate, and a head secured to the end of such spirally wound plate which is opposite the cutting edge thereof and adapted to be secured to the lower end of the drilling stem, whereby the bit may be rotated in drilling a well.

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